ANATOMY OF THE PORTUGUESE STOCK MARKET

RISK AND RETURN IN THE 1977 – 2012 PERIOD

Dissertation for obtaining the Degree of Master in Business Administration

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Abstract

This paper analyses the Portuguese stock market since it reopened in 1977, with a special focus on the evolution of the statistic and stochastic characteristics of the market return throughout this 36 year period. The market return for the period of time between 1977 and 2012 (September 28th) is estimated and then compared with the return that would have been achieved with Government bonds and treasury bills, which allows us to confirm that the hierarchy of return / risk across the different financial instruments is verified. The market risk premium for this 36 year period is also estimated and a comparison with other markets is performed, suggesting that the Portuguese market's risk has not been compensated by an adequate return. The study also examines the evolution of the Portuguese market's volatility in the 1977-2012 period and compares it with other markets, showing the existence of extremely high peaks during the first 11 years, but indicating a downwards trend throughout the whole period under analysis. Finally, the correlation between market returns for Portugal and for other countries and the degree of integration are estimated and their evolution throughout time is assessed, leading to the conclusion that the performance of the Portuguese stock market has become increasingly correlated with major European markets – correlation with some markets close to 0.70 from 2000 onwards-, but that country-specific risk factors are still relevant.

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1 – Introduction

The Portuguese stock market has undergone a sustained expansion over the last 36 years. The increasing number of listed companies, market capitalisation and trading volumes, the widening range of sectors represented in the market and the rising number of market players and instruments available are a clear illustration of that development.

Many academic papers that study equity markets and estimate historical returns, historical volatilities, risk premiums, correlations and country-specific risk factors do not cover the Portuguese stock market. Perhaps the small size and the poor liquidity of the Portuguese market until 1970 or the "shortness" of the period of time that has elapsed since the market reopened in 1977 or since it reached a "decent" size in terms of number of listed companies, market turnover and market capitalisation in 1988/1989 are behind the scarcity of papers including the Portuguese market in global analysis of equity markets.

This paper examines the risk and return of the Portuguese stock market since 1977, including the analysis of the statistic and stochastic characteristics of the market return throughout this 36 year period. The study explores the application of the main ideas and concepts of the finance theory to the Portuguese market in the 1977-2012 period, estimating the main variables, assessing their evolution throughout time and performing comparisons with other markets. The following items are estimated and analysed: historical market return; stock market performance in nominal and in real terms and comparison with government bonds, treasury bills and other major markets; risk premium and its evolution; market's volatility and its evolution; market's correlation with other developed markets and its evolution; country-specific risk.

The estimation and assessment of the aforementioned items and the analysis of their evolution throughout this 36 year period is carried out through quantitative methods and complemented by the analysis of the evolution of the political, economic and social backgrounds, namely of the important changes the country and the market underwent during this period of time, such as the privatisation programme and the accession of Portugal to the European Union. The privatisation programme was of particular importance, as it brought to the stock exchange big companies from sectors not yet represented in the market and with high free-floats, attracting international institutional investors; while Portugal's European integration enabled the harmonisation of legislations and reduced the country's political risk, enhancing economic growth prospects.

The paper comprises a literature review focused on major finance topics, namely risk and return, risk premium and correlation of returns between markets and covers specific topics that are important for the analysis of the Portuguese stock market, such as country-specific risk, privatisations vs. market development, emerging markets vs. developed markets, and markets integration. Bibliography includes papers, articles and books on Finance as well as more general sources on Portugal's recent History and on the Portuguese stock market.

The risk / return analysis is to a large extent performed out of historical series of market indexes, which were mainly obtained from Bloomberg, namely in what concerns Portugal and major international stock markets. Additional data on the Portuguese stock market was collected from Euronext Lisbon and CMVM. Bank of Portugal, IGCP, CMVM, Euronext Lisbon

and Bloomberg were also important sources for complementary quantitative information, namely on economic indicators, on risk and return of other types of securities, on inflation and on trading volumes and market capitalisations.

This project hopefully contributes to a better understanding of the Portuguese stock market and of its development since it reopened in 1977.

The following **theoretical hypotheses** are **tested**:

- **The historical return of the Portuguese Equity market in the 1977-2012 period has translated into risk premiums on other types of financial instruments, namely government bonds and treasury bills, consistent with the hierarchy of risks.**
- **Over the last 36 years, the volatility of the Portuguese stock market has been falling and converging towards the levels recorded in developed markets.**
- **The weighting of country-specific risk factors has been falling over the last 36 years and Portugal's equity market performance has become more correlated with the evolution of international stock markets.**

The analysis of the political-social-economic background and other non-quantitative information is based on the literature available on the recent evolution of Portugal's economy and capital markets.

The estimation of indicators for different periods of time, namely before and after key events or key processes (such as the granting of incentives to the listing of companies, the privatisation of large companies, the accession of Portugal to the European Union or Portugal's participation in the single currency project) that shaped the market, contributes to a better understanding of the evolution of the Portuguese stock market's risk and return throughout the 1977-2012 period, while the comparison with international reference markets allows a better understanding of the evolution pattern towards higher development and towards more integration / correlation.

A limitation this project faces is the relatively small size of the period under analysis (36 years), which could have conditioned the calculation of some indicators usually estimated with very long series and consequently prevented or jeopardised the comparison with statistics available for other markets. However, the main motivation to perform this work is the firm intention of getting a better understanding of the Portuguese stock market's performance and evolution and the analysis performed in this project, regardless of the limitations, gives its little contribution towards the achievement of that goal.

This analysis concludes that in overall terms it compensated to invest in equity vis-à-vis other financial instruments such as government bonds or treasury bills, but that Portugal's performance compares unfavourably with other markets in terms of return obtained vs. risk associated. It also concludes that throughout the last 36 years the volatility of the Portuguese market has come down and that the market's performance has become increasingly correlated with the evolution of major international markets.

2 - Evolution of the Portuguese Stock Market between 1977 and 2012

2.1. Background

As a result of the sustained economic growth (annual GDP growth rate between 6% and 11%) and of the new political cycle, the Lisbon stock market experienced a significant expansion between 1970 and 1973, with new companies entering the market and share prices rising more than 100% in accumulated terms. In April 1974, before the revolution, Lisbon's stock market capitalisation amounted to 300 million contos (approximately €1.5bn) and corresponded to more than 80% of the country's annual GDP. Only 26 years later, in year 2000, this ratio would be surpassed.

However, in 1974 the market regulation from 1901 was to a large extent still in place, term transactions ("opções" and "prémios") had not yet been resumed since they were suspended in 1950 (Santos, 2001) and market information was not fully reliable (Justino, 1994). Liquidity was also poor and in 1973 the volume of shares traded represented only 6% of the year end market capitalisation.

Figure 1A in the Annex presents the composition of the Portuguese stock market in 1973, comprising the 85 most liquid companies. The banking sector accounted for almost half of the market (a pattern that would be repeated twenty years later), while the energy sector, although represented through several companies, corresponded to less than 5% of the market. It is also worth mentioning the weighting that industrial companies had in total market capitalisation, almost 30%, as well as the listing of companies from the tourism sector and from the overseas territories.

On April 29th, 1974, following the revolution on April 25th, "Junta de Salvação Nacional" suspended all the trades with securities, including those taking place in stock exchanges, and the stock market activity was shut down.

In 1974 the Portuguese economy expanded only 1.1%, well below the 11.2% growth rate recorded in 1973, and in 1975 it shrank 4.3% (Ramos, 2009). A new constitution was approved in April 1976, foreseeing the progression of Portugal towards socialism.

2.2. The Early Years

The Portuguese market reopened in January 1976 for the trading of bonds. On February 28th, 1977, market sessions were resumed for all securities, including stocks (Santos, 2001).

In 1977 the Portuguese stock market was extremely small and operated only on Mondays, Wednesdays and Fridays. Most of the companies that were listed in the stock market in 1974 were nationalised in the following years and when the market reopened in 1977 the companies from the banking, insurance, cement, heavy industry and power sectors, that accounted for more than 90% of the market capitalisation and trading volume before the revolution, were in the hands of the State. The stock market reopened with the companies that were listed on April 24th 1974 and that were not nationalised or that did not suffer any other kind of transformation in the following three years.

The following table is an extract of *Boletim de Cotações* from December 31st, 1977. There were 36 listed companies (and 38 stocks) at the time, but out of these only 11 stocks traded in 1977.

Figure 1 – Companies Listed in the Portuguese Stock Market as at 31 December 1977

Sector	Company	Year of latest trade	Market Cap PTE '000	Sector's weighting
Food and Beverages	Compal	1974		
	Aliança	1974		
	Moagem Lisbonense	1951		
	Padarias	1977	13 250	
	Portugal e Colónias	1977	400 000	14,91%
	Curia	1977	75 000	
	Luso	1974		
	Vidago	1977	273 000	
Textile	Torres Novas	1977	33 000	0,65%
	Oriental	1945		
Media	Livraria Bertrand			
	Primeiro de Janeiro	1965		
Chemicals	Mabor	1974		
	Gases e Produtos Químicos			
	União Fabril Farmacêutica	1974		
Industry	Cerâmica Lusitânia	1967		
	Novinco	1962		
	Fornos Eléctricos	1977	142 000	
	Jotocar			4,94%
	Efacec	1974		
	F. Ramada	1977	110 000	
	Fábrica Portugal	1944		
Shipyard	Lisnave	1977	1 125 000	22,04%
	Metalurgia Casal			
Telecommunications	Rádio Marconi portador	1977	2 900 300	56,82%
	Rádio Marconi Nominativas	1977		
Commerce	Cafés Reunidos	1957		
	Empor	1974		
	Regisconta			
Others	Comp. Águas de Lisboa Port.	1974		
	Comp. Águas de Lisboa Nom.	1973		
	Pesca Lusitânia			
	Prestamista Portuguesa	1977	33 000	0,65%
	Recreios Lisbonense	1950		
	Ribatejana	1971		
	Tauromáquica Lisbonense	1974		
TOTAL			**5 104 550**	**100,00%**

Source: Euronext Lisbon

In 1977, the stock market capitalisation (year end) amounted to 5.1 million contos (€25.5m), less than 2% of the market capitalisation in 1974, and the trading volume reached 9 thousand contos (€45.000). Marconi was by far the most important listed company, representing more

than half of the market. Lisnave and Portugal e Colónias were the second and third biggest market capitalisations, respectively.

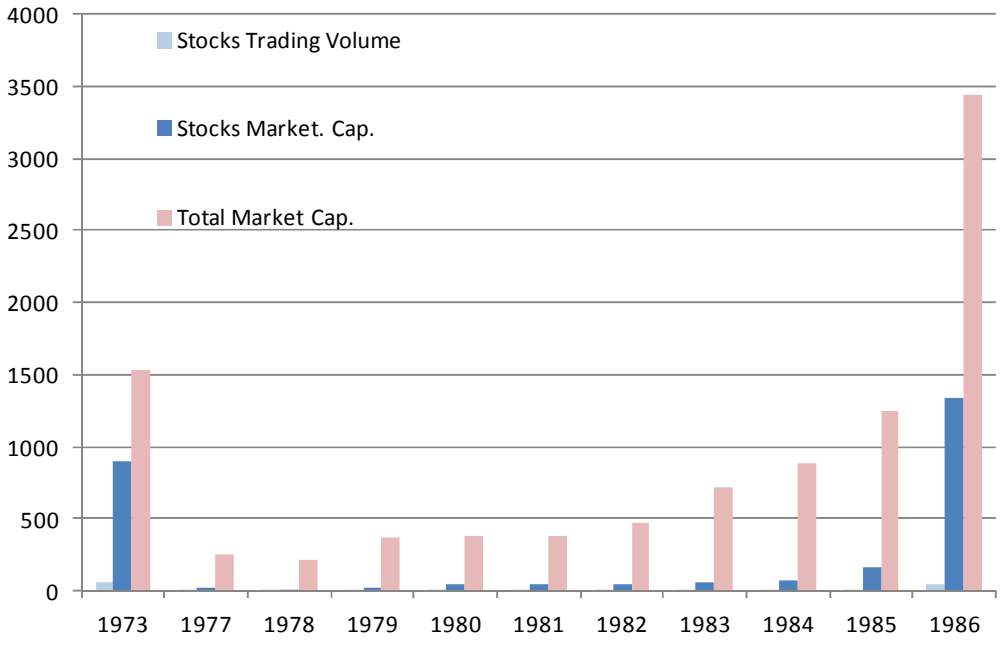
During the 1977-1984 period the market remained dormant, both in terms of number of listed companies and trading volume. During this period of time, Portugal was bailed out twice by the International Monetary Fund, in 1978 and in 1983.

In 1982, Maria Irene Carvalho and António Mendonça Pinto urged the adoption of specific measures, namely fiscal incentives and the creation of new market instruments, to promote the development of the Portuguese stock market, arguing that the country's objective of increasing (production oriented) investment designed to increase exports or reduce imports, financed by internally generated resources, depended on the existence of a developed stock market.

In 1984 there were 23 listed companies, of which 19 traded during the year with a volume of 126 thousand contos (€629.000). The stock market capitalisation amounted to 13.3 million contos (€66.5m) as at December 31st, four times as much as in late 1977. However, adjusting for the high inflation recorded in the 1977-1984 period, in real terms market capitalisation stood at the same level as in 1977.

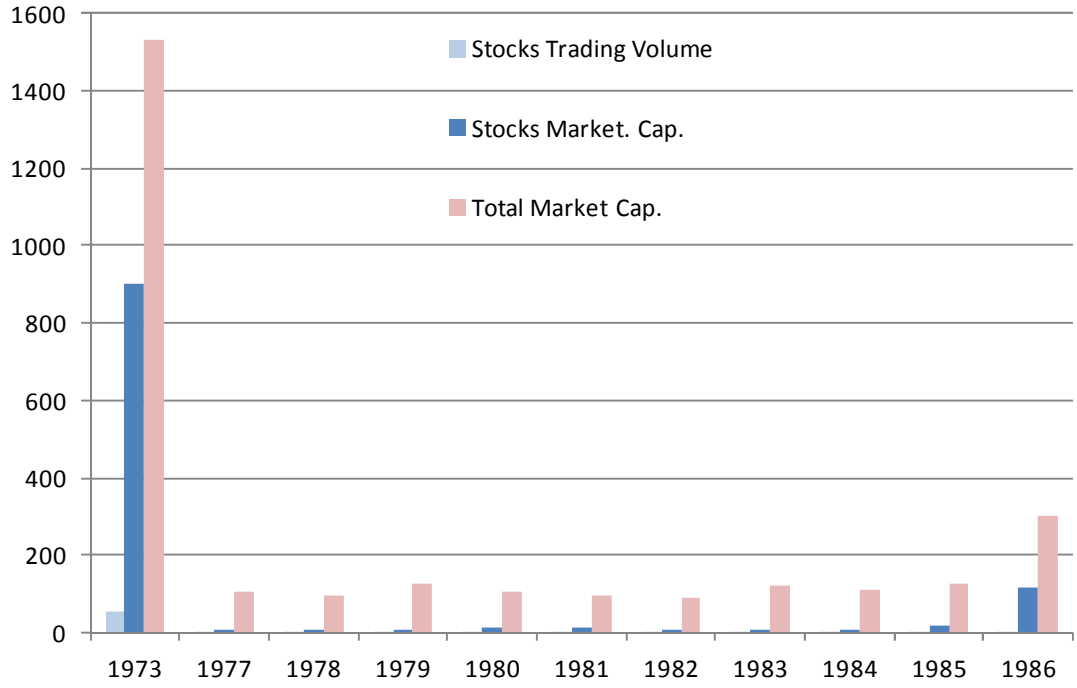
As at December 1984, Marconi was still the biggest company in terms of market capitalisation (20.5% of the total), while Efacec (18.7%) and Estoril Plage (17.3%) ranked second and third, respectively. Lisnave was still listed, but represented only 6% of the market. As a clear evidence of the market's poor liquidity, Estoril Plages's shares did not trade in 1984.

Figure 2a – Main Statistics for the Portuguese Stock Market in the 1973 – 1986 Period
(data in million Euros)



Source: "O Mercado Bolsista Nacional: de 1973 à UEM" in Bolsa de Valores de Lisboa – Estudos e Artigos

Figure 2b – Main Statistics for the Portuguese Stock Market in the 1973 – 1986 Period at 1973 constant prices (data in million Euros)



Source: "O Mercado Bolsista Nacional: de 1973 à UEM" in Bolsa de Valores de Lisboa – Estudos e Artigos; Banco de Portugal

In 1985 the stock market experienced some more dynamism, with the trading volume more than doubling the previous year level, but it was not until 1986 that the market's growth path changed considerably.

2.3. The 1986 – 1988 Expansion

In 1985, the centre-right social democrats won the general elections and Prof. Cavaco Silva became Prime Minister. Two years later new general elections took place and Prof. Cavaco Silva was confirmed as Prime Minister, but this time his party got more than half of the seats in the parliament, assuring a single party majority, something that had not yet happened since 1976. This achievement (single party majority) was repeated in the following general elections in 1991.

In January 1986 Portugal became a member of the European Union (European Economic Community at the time) and the country entered a period of sustained growth, with GDP expanding at a 5.6% average annual rate by 1992 (Ramos, 2009).

The direct and formal approach made by the Ministry of Finance to major companies, inviting them to become listed in the stock exchange, combined with a comprehensive set of fiscal incentives to issuers and investors, fuelled the expansion of the market in 1986 – 1988.

The political stance of transmitting a new dynamism to the Portuguese stock exchange through fiscal incentives started in 1982 through Decree-law 409/82 from September 29th, which exempted – from taxes on capital gains and from stamp duty - the gains obtained through share capital increases that resulted into a minimum level of dispersion. The Decree-

law also allowed companies to deduct dividends paid up to 10% of the capital represented by new public offers in the following 5 years. These measures had nevertheless little impact, as only one public offer took place in the following months / years – Marconi, in December 1983 (Alpalhão, 1988)

Decree-law 182/85 from May 27th enlarged the time horizon for fiscal benefits foreseen in previous legislation and also granted some incentives to potential investors. However, no public offers took place in 1985. Decree-law 172/86 from June 30th substantially enlarged the scope of incentives, allowing a 50% deduction in the "Contribuição Industrial" rate in the first three years following a public offering that opened to the public 25% or 20% of a company's share capital. Decree-law 130/87 from March 17th further extended the list of benefits.

The first initial public offer that took place in Portugal since the market reopened in 1977 was Companhia Portuguesa do Cobre's on November 7th, 1986. Several other offers followed in the subsequent months and the number of companies listed in the main market increased to 40 at the end of 1986, to 111 at the end of 1987 and to more than 140 in 1988. The companies that opened their capital to the public during this period were mainly from the industry (59% of the total) and opted to place on average 25% of their share capital.

However, in 1988 the Portuguese stock market could not yet be seen as a "real financing option" that could spur the growth strategy of the main Portuguese companies, as only seven companies (Soares da Costa, Salvador Caetano, Soporcel, Marconi, Efacec, Lisnave and Fisipe) out of the country's twenty largest private companies – excluding local subsidiaries of multinational companies – were listed. Maybe because of the traditional reluctance in opening a company's share capital to new investors or because of the trauma created by the April 25th revolution, companies still elected debt as the main financing source (Alpalhão, 1988).

The evolution of the number of brokers / dealers operating in the market also reflected the change in the number of listed companies, growing from only four in 1986 to nine in 1987. In this year, the market still operated only four days a week (from Tuesday to Friday), but the ratio "Stocks Trading Volume / Stocks Market Capitalisation" reached 12% and surpassed for the first time the level achieved in 1973. In 1987 the market performance could already be measured through three main indexes: BTA, BPSM and BVL (Nabais, 1987).

2.4. The Privatisation Driven Market Boom of the 1990s

In 1989, the two biggest political parties, PS and PSD, agreed on a revision of the Portuguese Constitution. With the amendments made to the Constitution, the privatisation of State owned companies became possible in Portugal. This was the second revision / change to the 1976 constitution. The first review / change had taken place in 1982, but at the time there was no political consensus on the possibility of privatising State owned companies (Saraiva, 1993).

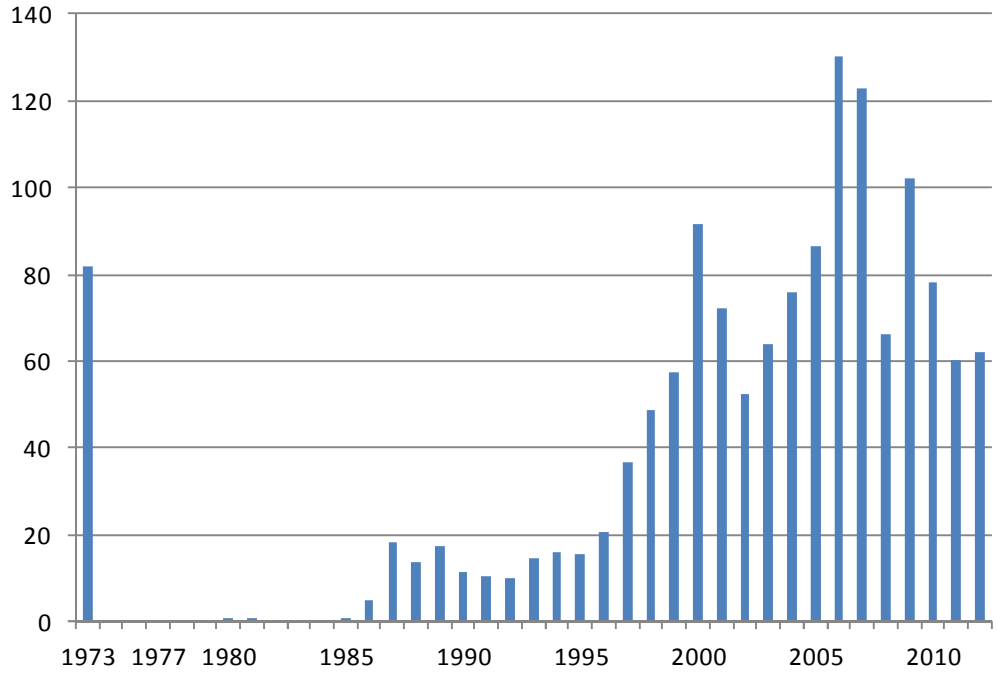
Law n. 11/90 from April 5th was the first general law on privatisations and aimed, amongst other objectives, to contribute to the development of the Portuguese capital markets. Between 1990 and 1999, the Portuguese State raised more than €15bn from privatisation processes (Carvalho, 1999).

The market underwent a period of sustained expansion by 1999, underpinned by the privatisation of companies, by the sustained fall in interest rates and by the prospects of Portugal joining the single currency.

Market capitalisation went up 160% between December 1988 and December 1995 to €13.7bn, mainly reflecting the rising number of listed companies. In fact, stock market indexes went up approximately 20% in accumulated terms between 1988 and 1995. In 1995, the trading volume reached €3.2bn.

The period between 1996 and 2000 was of great dynamism and led the market into a higher path, with market capitalisation increasing by 8.5 times to €116bn and annual trading volume rising 19 times to €59bn. Only partly this evolution reflected the good market performance - stock market indexes tripled in this period, an impressive evolution, but still much less than the market's overall growth -, as the key driver were the several privatisation processes that took place in the period.

Figure 3 – Portuguese Stock Market Capitalisation as a Percentage of GDP in the 1973 – 2012 period



Source: "O Mercado Bolsista Nacional: de 1973 à UEM" in Bolsa de Valores de Lisboa – Estudos e Artigos; Euronext Lisbon; CMVM; INE; Banco de Portugal; European Commision

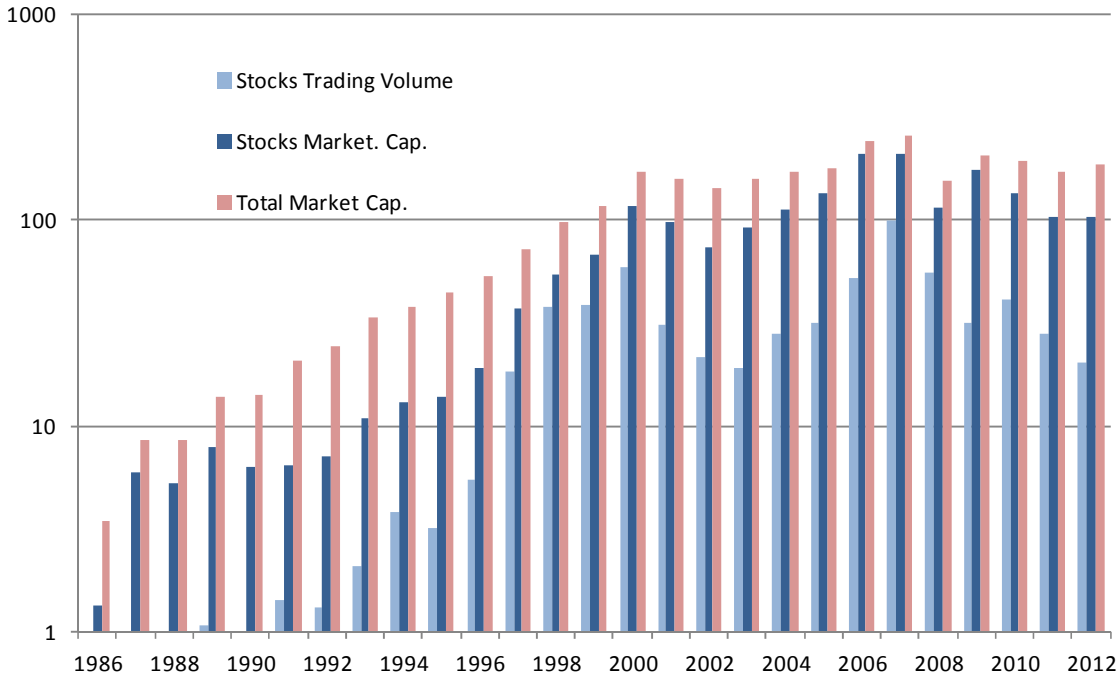
The market's sustained expansion was accompanied by the publication of the new Securities Market Code ("Lei Sapateiro") in April 1991, which provided a more modern and more comprehensive legal and regulatory framework. Also as a result of this increased dynamism and in order to meet investors' needs, the trading of futures was launched in June 1996 (initially comprising futures on the PSI-20 index and on OT-10) and three years later, in March 1999, the trading of options became available.

On December 2nd, 1997 the Portuguese market was included in the Morgan Stanley Capital Index for developed markets (Portugal became the 22nd member), which, by "requiring" an

exposure to Portugal to those funds using the index as a benchmark, attracted a new set of international investors and increased the market's visibility.

The listing of large companies from representative sectors and with high levels of free float raised the interest of institutional investors and of many domestic individual investors. The first phase of EDP's privatisation, in 1997, attracted 772.584 investors, while the second phase, in the following year, attracted more than 800.000 investors.

Figure 4 – Main Statistics for the Portuguese Stock Market in the 1986 – 2012 Period
(data in thousand million Euros)



Source: "O Mercado Bolsista Nacional: de 1973 à UEM" in Bolsa de Valores de Lisboa – Estudos e Artigos, Euronext Lisbon and CMVM

In 1999, out of the 74 companies listed in the "Mercado de Cotações Oficiais", more than 1/5 were companies that had been privatised in the previous years, representing 55% and 59% of the "Mercado de Cotações Oficiais"'s market capitalisation and trading volume, respectively. In that same year, the top ten of market capitalisations comprised seven "privatised" companies - PT #1, EDP #3, BESCL #6, Brisa #7, BPSM #8, Cimpor #9, Mundial Confiança #10 -, while the top ten of trading volumes included five "privatised" companies - PT #1, EDP #3, Cimpor #6, BPSM #7, BESCL #10 (Carvalho, 1999).

The primary market's high dynamism translated into a much more active secondary market and in 1998 the equity market accounted for 97% of the market's overall trading volume.

In January 1999, stocks (and other securities) started being traded in Euros, which paved the way for the following consolidation phase.

2.5. The Consolidation Phase

In 2000, the Portuguese stock market finally reached a market capitalisation (€116bn) as a percentage of GDP above the level recorded in 1973 (91% vs. 83%) and recorded a €59 billion trading volume, a level that has not been reached again. Market capitalisation came down to levels below the €100bn mark in 2001-2004, but recovered in the following years, reaching a peak in 2006/2007, when it surpassed the country's GDP and the €200bn level for the first time. As a result of the market's negative performance, market capitalisation came down in the following years and currently remains in the €100bn region.

In February 2002 the merger of the Portuguese stock exchange with Euronext N.V. was accepted by the respective shareholders and the Portuguese market saw its name changed to Euronext Lisbon.

Between 2000 and 2012 the stocks market's annual trading volume as a percentage of market capitalisation remained in the 18% to 52% range.

During this period of time, the ratio "market capitalisation as a percentage of GDP" evolved towards the levels recorded in reference markets - namely Germany, where the ratio has remained between 30% and 70% since 2000 -, but liquidity indicators still remained below the levels seen in major markets, where the trading volume typically represents 50% to 100% of the market capitalisation.

Currently, Portugal is still a member of the benchmark MSCI Developed Markets Index. In order to be in this category, a country must meet requirements of economic development (GDP per capita 25% above the World Bank high income threshold – of USD 12,276 - for three consecutive years), of market size and liquidity (at least five listed companies with full market capitalisation on top of USD 1,796m, float market capitalisation on top of USD 898m and annualised turnover volume ratio of at least 20%) and of market accessibility (openness to foreign ownership; ease of capital inflows / outflows; efficiency of the operations framework; and stability of the institutional framework). Apart from Portugal, only 23 other countries are members of the MSCI Developed Markets Index: 13 EU members, Norway, Switzerland, Australia, Hong-Kong, Japan, New Zealand, Singapore, Israel, Canada and the USA.

At the June 2012 review, Portugal got the maximum classification ("no issues") in 15 out of the 18 sub-criteria of the market accessibility criterion and the classification of "no major issues" in the remaining three ("stock lending"; "short selling"; and "stability of institutional framework"). All the other European countries that are members of the MSCI Developed Markets Index got the maximum classification in all the sub-criteria, with the exception of Greece (1 "no major issues" and 4 "improvements needed/extent to be assessed"), Ireland (2 "no major issues"), Italy (1 "no major issues"), Spain (2 "no major issues") and Sweden (1 "no major issues").

Over the last 15 years, only three countries were "promoted" to the Developed Markets category of MSCI Indexes: Portugal in 1997, Greece in 2001 and Israel in May 2010. At the moment this text is being written, Korea and Taiwan are under a review process for a potential reclassification from Emerging Market to Developed Market, while Greece is under review for a potential downgrade to Emerging Market. Portugal is therefore part of an "elite" of stock

markets, meeting requirements that are not fulfilled by countries such as Brazil, Chile, Czech Republic, Poland, Turkey, South Africa, China or Qatar, which fall in the Emerging Market or in the Frontier Market categories of MSCI's indexes.

3 – Litterature Review

3.1. Review of Key Concepts - Risk, Return and Risk Premium

As short term debt instruments issued by governments, **treasury bills** are commonly considered as the risk-free financial instruments. Treasury bills are usually placed through auctions and their rates tend to reflect short term money market rates, with investors usually seeking a remuneration that at least covers inflation. The remuneration of treasury bills issued by AAA countries, such as the USA, Germany or Switzerland, may be considered as proper risk free rates. In the case of the USA, the annual remuneration of treasury bills issued since 1900 averaged 4% (Brealey, 2011).

Government bonds are often viewed as a risk free benchmark, but as long term assets their remuneration is subject to changes in interest rates and in inflation – the former affecting the value of the bond and the latter conditioning the real rate of return. The possibility of having a change in the credit quality of the issuer and consequently on its ability to meet in the future a scheduled debt service is higher in a government bond than in a treasury bill, not only because of the larger time horizon of government bonds (that enhances the chances of "something going wrong") but also because short term debt instruments usually have a privileged treatment in sovereign debt restructuring situations. The remuneration of government bonds therefore presents more room for variability than the return on treasury bills.

Li (2002) found that in developed markets the correlation between **stock** and **bond** returns results from their common exposure to macroeconomic factors, with uncertainty about expected inflation being the primary factor. However, the return an investor can obtain from stocks is typically subject to more factors of uncertainty than the return that can be obtained from a bond, namely the company's fundamentals and its prospective performance (apart from inflation, interest rates, country credit risk), which translates into a higher variability and consequently into higher required rates of return.

Different companies are subject to different types of risk (specific risk), meaning that their shares' prices may react in different magnitudes or in different directions (positively or negatively) to the same news or event and also meaning that the diversification of stocks dilutes each stock's **specific risk**. A set of 20 stocks is believed to substantially dilute specific risks (Brealey, 2011), with little more than the market risk being left in the portfolio.

The average return of a portfolio of stocks representative of the market on excess of the risk free rate is the **market risk premium**. The risk premium is usually estimated out of very long series of market returns, in many cases more than 100 years (Dimson, 2001), covering periods of expansion and periods of contraction, providing a long term perspective and therefore leading to a balanced result. Dimson (2001) estimated the risk premium of several developed markets (using market data series starting in 1900) and reached values between 4.3% (Denmark) and 10% (Italy). Dimson (2006) also estimated an annualised equity premium for a world index of 4.7% on the US treasury bills and of 4.0% on government bonds.

Welsh (2000) presented 7% per year over a 10 to 30 year horizon as the (arithmetic) consensus equity premium forecasted by 226 "academic financial economists". Forecasts averaged 2% in a pessimistic 30 year scenario and 13% in an optimistic 30 year scenario, with respondents to

Welsh's inquiry confirming that they revise their projections downwards when the market goes up.

The use of very long series does not capture, however, **changes** in the market risk premium throughout time that may result, for example, from improved / worsened economic or political conditions. Dimson (2006) analysed real equity returns in key markets over selected periods of extreme turbulence (the two world wars and "three great bear markets" – Great Depression in 1929-1931, First oil shock in 1973-1974 and the post-internet bubble in 2000-2002) and found that different markets faced substantially different odds in terms of performance and that the real rate of return changed dramatically over these periods.

The **Capital Asset Pricing Model** (CAPM) explains the expected return of a stock (or portfolio of stocks, or market) out of the risk free rate, the market risk premium and the stock (or portfolio of stocks, or market)'s sensitivity to market movements (**β**). Black (1972), in his assessment of models of pricing capital assets, starts mentioning that the main result is "the statement of the relation between the expected risk premiums on individual assets and their systematic risk", before presenting evidence that the expected excess return on an asset was not fully proportional to that asset's Beta.

The **Sharpe ratio** (risk premium / standard deviation) measures the relation between the risk premium and the variability of the return on a stock or on a portfolio of stocks. The calculation of the Sharpe ratio for different markets allows the assessment of how well the risk of a specific market is being remunerated.

French (1987) found evidence that the expected market risk premium (risk premium calculated on treasury bills) is positively correlated with the expected volatility of stock returns. Similarly to the CAPM, the **Asset Pricing Theory** (APT) developed by Ross also assumes that the expected return on a stock depends on systemic risk, but states that a stock's return reflects several macroeconomic factors, with each of those factors having a specific weighting on the stock's return.

In an empirical implementation of the APT, Fama and French (1992) developed the **Three Factor Model**, in which return is explained by three factors – market, size and book-to-market. Fama and French estimated the size effect (SMB = "Small minus Big") in average returns at 0.20% per month and the book-to-market effect (BE/ME, value vs. growth) at 0.50% per month. Davis (1999) confirmed the positive relation between book-to-market equity and average return and defended that the three factor risk model could better explain the value premium. In his analysis of monthly returns for more than 29,000 stocks from 49 countries in a 30 year period, Hou (2011) rejected the covariance risk and favoured a characteristic model based on book-to-market and size factors.

3.2. Transposing the Analysis of Key Concepts to the Portuguese Stock Market

3.2.1. Hierarchy of Returns, Required Rates of Return

When applying some of the aforementioned concepts and principles to a specific country such as Portugal, several issues arise, with the "proper" risk free rate and the estimation of the risk premium on the top of the list. In fact, Portugal's credit worthiness has been below reference

countries such as Germany or the USA and has substantially deteriorated over the last four years, meaning that the "Portuguese risk free rate" calculated out of Portuguese treasury bills carries a premium on the US or German risk free rates.

The estimation or the assessment of required or fair rates of return can hardly be performed without the analysis of past performances. However, while "recent" statistics on market returns are widely available, it is much more difficult to find reliable data over the long term. Long series of accurate historical records are available for the North American market, but the USA has been an outstanding successful economy, therefore it would be "dangerous" to estimate required returns for other markets simply based on the US market performance (Dimson, 2001).

Alpalhão (2004) concluded that the Portuguese market was more exposed to risk than other Euronext member markets. Accordingly, the valuation of the Portuguese equity market should bear a higher risk premium. Extrapolating to markets / countries Ang (2002)'s idea that investors demand higher return on stocks with greater downside risk, Portugal's higher number of years with negative returns when compared with other markets should justify a higher risk premium .

Evidence suggests that "skilful and well prepared investors" can explore market inefficiencies and achieve abnormal profits above returns obtained out of standard strategies based on size, value or momentum (Coval, 2005). The developments undergone by the Portuguese market in 1985-1987, when the lack of preparation of many players combined with the small size of the market translated into abnormal returns, seem to confirm this idea. Daniel (1997)'s integrated theory that investors overconfidence in evaluating securities prompts over reaction to the arrival of private information and under reaction to the arrival of public information can also be transposed to the unique situations recorded in the Portuguese market during that period of time.

Areal (1999) obtained mixed results regarding the mean aversion/reversion behaviour of the Portuguese stock market returns and pointed out the "euphoria" of the 1985-1987 period, the existence of moving risk premiums and the weak trading volumes as possible causes for those inconclusive results. According to Korajczyk (1995), mispricing may be more pronounced in "periods of economic turbulence and periods in which capital controls change significantly".

As mentioned before, only in 1997 Portugal was "promoted" from the emerging market category to the developed market category (MSCI Indexes). Rouwenhorst (1998) concluded that emerging market stocks exhibit momentum, that small stocks tend to perform better than large stocks and that value stocks outperform growth stocks. Still according to this author, "it is unlikely that liquidity can explain the emerging market return premium". Bekaert (2006) presents an opposite view, considering liquidity as a major driver in expected returns in emerging markets. This is in line with Pastor (2001)'s findings that stock returns partly reflect the sensitivity to changes in aggregate liquidity, with the average return on stocks highly sensitive to liquidity exceeding by 7.5% in annual terms the average return on low sensitivity stocks.

3.2.2. Falling Volatility and Convergence towards Developed Market Patterns

Ghysels (2011) stated that it is well assumed that the unconditional mean and volatility of returns is higher in emerging markets than in developed markets, which drives us to the idea of an emerging market risk premium. Morck (1999) found that stock prices move in a more synchronous way in low-income economies than in high-income economies, but did not attribute this behaviour to differences in market size or economy size. After rejecting the possible higher correlation in companies' fundamentals in low income economies as the cause for the synchronised movements, Morck concluded that the weak institutionalised respect for property and for property rights could be a main cause, as it favours market-wide price swings motivated by political events and rumours. The poor protection of public investors from corporate insiders - seen in low income countries - is another cause pointed out by Morck, as it makes "firm-specific information less useful to risk arbitrageurs". The idea of extraordinary returns in emerging markets collides with Griffin (2010)'s findings that "short-term reversal, post-earnings drift, and momentum strategies earn similar returns in emerging and developed markets", which corrected the "misperception" that emerging markets present higher trading profits.

Patel (1998), in his analysis of stock market crises in developed and emerging markets throughout a 30 year period found that in developed markets each crisis tends to be less severe that the previous crisis, in terms of duration and price correction. The author did not confirm this trend for emerging markets, having realised instead that in these markets price downwards adjustments (in a crisis) are quick and severe while recoveries are slow, usually taking three years.

Girard (2007), in his comparison of developed markets vs. emerging markets, found that emerging markets showed a more significant response to big information shocks than developed markets and that also presented higher sensitivity to unexpected volume.

Still according to Ghysels, the first and the second moments are not sufficient to perform a complete characterisation of financial risks present in emerging markets. Because these countries are, by nature, more vulnerable to political crises, liberalisation and regulatory changes and other shocks, market returns will more easily deviate from normality.

The privatisation process shaped the Portuguese stock exchange, bringing the large companies into the market and providing a wider sector diversification. Apart from significantly increasing the market size and liquidity, privatisations also impacted on the structure of share ownerships, promoting a higher presence of domestic investors and the entry of international investors. If properly carried out, privatisation may have a major impact on the development of a stock market, which in turn will "yield economic and political dividends for many years" (Boutchkova, 2000). Perotti (1999) found that the impact of privatisations is positive before, after and long time after they take place, concluding that the "resolution of political risk resulting from successful privatisation has been an important source for the rapid growth of stock markets in emerging economies". As defended by Tadesse (2005), stock markets may be vehicles for economic development and public policy can positively contribute to the effectiveness of equity markets in providing governance services through enhanced market liquidity.

Enhanced size and liquidity, better governance and increasing global integration should translate into a reduction in risk premium. Alpalhão (2004) viewed the merger of the Lisbon stock exchange with the pan-European platform Euronext as a risk reduction factor that should have translated into an adjustment of the risk premium required for Portuguese blue chips. Goeij (2009) showed that market size significantly impacts on expected returns - especially in emerging economies -, as expected returns reduce substantially in larger markets, concluding that "as markets integrate and expand, expected returns fall due to the decrease of both size and segmentation premiums", with the size premium being more persistent.

The sustained development of a market should also translate into a reduction of noise factors, such as seasonality. Balbina (2002) found evidence of seasonality (across the days of the week) in the return of the Portuguese stock market in the 1988-1996 period, but concluded nevertheless that it tended to decrease as the "market became more mature" as a result of foreign capital inflows and of the privatisation process - which "changed the shape and the size" of the market and culminated in the upgrade to the "developed market" status in 1997 - and that it disappeared in the 1997-2001 period.

3.2.3. Increasing Integration with Other Markets and Falling Weighting of Country-Specific Risk Factors

Markets are integrated when financial assets with the same risk present the same expected return regardless of the domicile. When markets are not financially integrated – for example due to barriers to capital flows – the price of risk will likely be different from market to market (Korajczyk, 1995): as markets are segmented, "the parameters of the asset pricing model are different across markets".

Argyropoulos (2006) examined the question on whether the Greek market presented the characteristics of a developed market or of an emerging one. Having estimated the level of integration with other markets through the degree of correlation and through the co-integration relationships between Greece and other markets, the author concluded that Greece performed as an emerging market in the 1990-2000 decade, having evolved to a more integrated market with the developed markets after the launching of the Euro.

Bose (2006) analysed the degree of integration of the Indian Stock Market with the US, Japan and other Asian stock markets by using daily data for the five and a half year period from 1999 to June 2004. Average daily returns for each market were estimated and compared, as well as Maximum and Minimum daily changes, standard deviations, skewness and kurtosis. Cross correlations were calculated, which, combined with the results of co-integration and causality tests, supported the conclusion that the Indian market belonged to "the group of Asian markets co-integrated within themselves and with the US market".

Considering the lower maturity of the Portuguese market vis-à-vis other markets, namely in terms of number of years of track record, number and size of listed companies or number of investors and analysts following the market, the Portuguese stock market should be more exposed to country specific risk factors. While large capitalisation stocks and growth stocks (high price-to-book stocks) tend to underperform because they are more likely to be stocks with positive pricing errors, small capitalisation "traditional" stocks – the typical profile of the

Portuguese listed companies in 1985 – 1987, for example - are more likely to be stocks with negative pricing errors and therefore tending to outperform the market (Arnott, 2006). Liewa (1999) confirmed that small capitalisation stocks may be more sensitive to changing economic conditions as "they seem to be entrenched in their respective categories".

In the case of Portugal vs. Europe, the convergence towards the Economic and Monetary Union and the adoption of the single currency contributed to a higher stock market integration through lower investment barriers, with the EU-wide risk gaining relevance vis-à-vis the country-specific risk (Hardouvelis, 2001). However, Serra (2003) found lower volatility levels for the Portuguese market vis-à-vis the Eurostoxx50 index from 2002 onwards, as the correlation between the Portuguese sectorial indexes fell and the correlation between European sectorial indexes (Eurostoxx 50) increased, which suggested that the falling volatility of the Portuguese stock market was a result of lower correlation with international benchmarks.

The aforementioned global integration translates into an increasing correlation between markets, specially in periods of crisis such as the 2008-2012 period. Investors are more concerned with the risk of losses than with the risk of gains, meaning that risk should be dealt in an asymmetric way (Ang, 2002) and therefore also meaning that downside correlations are stronger (as it happened in the case of Portugal's correlation with other markets in 1988, 2001 and 2011) and reflect more accurately the nature of risk.

There are nevertheless country-specific risk factors that remain relevant. Country-specific total and idiosyncratic risks are to a large extent priced in an ICAPM framework (Bali, 2010), but the prices of total and idiosyncratic risks are substantially different from country to country. Evidence of integration of the five main European markets (France, Germany, Italy, The Netherlands and Spain) was presented by Capiello (2008), who nevertheless also found some significant country-specific prices of risk when the intertemporal risk factor was omitted. Aretz (2007) showed that book–to–market, size, and momentum captured cross–sectional variation in exposures to a broad set of macroeconomic factors potentially important for pricing equities, including innovations in economic growth expectations, inflation, the aggregate survival probability, the term structure of interest rates, and the exchange rate, concluding that the majority of macroeconomic fundamentals command significant risk premiums. Griffin found that domestic factor models explain much more time series variation in returns and usually present lower pricing errors than the world factor model. Moreover, the breakdown of world factors into internal and external components confirmed that the "addition of foreign factors to models led to less accurate pricing".

The recent sovereign debt crisis and bailout confirm to some extent the relevance of the country-specific risk. According to Razin (2001), a financial crisis with a capital flow reversal occurs "when a country shifts abruptly from a 'good' equilibrium with a low country-specific risk premium to a 'bad' equilibrium with a high country-specific risk premium and no foreign credit". The deterioration of external debt conditions translates into a rise in the country-specific risk premium, leading to higher nominal interest rates (Annicchiarico, 2010) and consequently to more demanding required rates of return.

4 – Data Description and Methodology

4.1. Return and Risk Premium

The **return on the Portuguese stock market** is estimated out of the performance of two representative indexes, more precisely the PSI Geral index (for the 1988-2012 period) and the synthetic index (for the 1977-1987 period) developed by Fernandes (2009) out of the daily prices series of the PSI-20 index and of the BT&A index.

The BT&A index was the main benchmark for the Portuguese stock market between 1977 and 1988 (when the PSI Geral index started being calculated). The BT&A index was discontinued in 2005, which prevents us from using a single stock market index in the assessment of the market performance between 1977 and 2012 (September 30th, 2012).

The PSI Geral index is a market capitalisation weighted index of the eligible companies listed on the Lisbon Stock Exchange. As a total return index, the PSI Geral index assumes that dividends paid by companies are reinvested in the shares of those companies and therefore its evolution reflects the stock market's overall return, ie capital gains plus dividends. The PSI Geral index is available from 1988 onwards - the index started being calculated in 1992 with reference to January 1st 1988.

The aforementioned synthetic index is a reconstruction of the PSI-20 index for the 1977-1992 period, based on the daily observations of the BT&A index (available between 1977 and 2005) and of the PSI-20 index (available since 1992, therefore co-existing 13 years with the BT&A index).

The PSI-20 index is a free float weighted index of the 20 largest listed companies. In spite of the smaller number of members vis-à-vis the PSI-Geral index, the PSI-20 index is also highly representative of the Portuguese market: as at September 2012, all the 20 PSI-20 index members were also members of the PSI Geral index with an overall weighting of more than 90% on the PSI-Geral index. The PSI-20 index's performance has therefore been highly in line with the performance of the PSI-Geral index.

In order to get the overall return (capital gains plus dividends) of the Portuguese market in a specific year prior to 1988, the market's average dividend yield of that year has to be added to the change of the synthetic index in that year. For example, in 1983 the synthetic index that reconstructs the PSI-20 index went up 25.9% and the market's average dividend yield amounted to 3.2%, which translated into a 29.1% (25.9% + 3.2%) total return in that year.

The estimation of the market's average dividend yield is only relevant (and is only made) for the 1977-1987 period. The market's average dividend yield corresponds to the market capitalisation weighted average of the dividend yields of the listed companies whose shares traded during the year (ie, the shares in which it would have been possible to invest). Dividend yield per company is calculated considering the market capitalisation at the beginning of the year, as the return is calculated on an investment made on January 1st of each year. As mentioned before, only the stocks that traded during the year are taken into consideration, which is paramount to reflect the market's actual activity. For example, as per the "boletim de cotações", at the end of 1977 there were 36 companies with shares listed in the Portuguese

market, but out of these only 10 traded during the year. The market's average dividend yield for 1977 was therefore calculated considering the dividend yield of these 10 companies and their market capitalisation at the beginning of the period (March 1977 in this case, when the market resumed its activity). Interestingly, in 1977 only one company paid dividends - Rádio Marconi – which made calculations for this year very easy.

Still another example: in 1983, five companies out of the 23 listed companies whose shares were traded during the year paid dividends - Padarias, Produtos Alimentares António e Henrique Serrano, Inapa, Efacec and Marconi. Weighting dividend yields - considering 0% for the companies that did not pay dividends - by the corresponding market capitalisations at the beginning of the year, a 3.2% average dividend yield for the market is obtained.

In order to get a more comprehensive idea of the performance of the Portuguese stock market since 1977, a comparison of returns is made with two reference markets: Germany and the USA. We are using the DAX and the S&P TR as the benchmarks for the German and US stock markets, as these are representative total return indexes, with long historical series of daily prices available.

The **return on the investment on Portuguese government bonds** is calculated on an annual basis, assuming i) the acquisition of a representative long term government bond at the beginning of the year (ideally, a liquid bond with a maturity close to 10 years) at market prices; ii) the collection of interests during the year; and iii) the sale of the bond at the end of the year at market prices. For example, in order to estimate the return on the government bond instrument in 1977 (-7.2%) it was assumed that "Tesouro 10% 1975/78/83" was acquired at the beginning of the year at 690$00, that the corresponding coupon (155$00) was collected during the year and that the bond was sold at the end of the year at 485$00, with the proceeds invested in the acquisition of "Tesouro 15.5% 1976/84".

Bilhetes do Tesouro are short-term debt securities issued by the Portuguese Government with maturities of up to one year. They are issued at discount and placed via auction or limited subscription offer and redeemable on maturity at face value. Bilhetes do Tesouro are therefore "Portugal's risk free instrument".

Bilhetes do Tesouro were only created in 1985 (Decree-Law n. 321-A/85 from August 5th), which meant that for the 1978-1985 period the average interbanking money rate (60-90 days) as published by the Bank of Portugal was used as a proxy to the risk-free rate. In 1978 this rate averaged 15.545% in annualised terms, meaning that 1000$00 invested in these instruments at the beginning of the year translated into 1155$45 one year later.

Unfortunately, Bank of Portugal's statistics are only available from 1978 onwards, which led us to find another proxy for the risk free rate in 1977 – we used the cap rate (11%) defined by the Bank of Portugal for passive operations between 180 days and 1 year, set by Bank of Portugal's *aviso* from Frebruary 28th.

For the 1986-1989 period, the average rate of the 12 month treasury bill auctions that took place in January of each year (as published by the Bank of Portugal) was used as the risk free rate of that year. For example, the average rate of the 12 month treasury bill auctions that took place in January 1987 was 13.016% - it was therefore assumed that the investor that

channelled his savings into this instrument in January 1987, obtained a 13.016% return one year later, in January 1988, when he reinvested principal and interests in the 12 month treasury bills auctioned in that month at a 14.173% average rate.

The TBA rate is published by IGCP since 1989, when this entity became in charge of the issuance of treasury bills. TBA reflects the annualised effective average rate of treasury bills auctions and was used as the risk free rate for the 1990-2002 period . For example, in 1993 the rate considered was 12.0441%.

From 2003 onwards, statistics on treasury bills' primary market are again available and we used the average rate of the 12 month treasury bill auctions that took place in January of each year (as published by IGCP) as the risk free rate for that year.

The Portuguese equity **market risk premium** for the 1977-2012 period is calculated out of the average annual total returns of the Portuguese stock market and of the Portuguese treasury bills over this 36 year period.

4.2. Risk

The analysis of the **volatility** of the Portuguese stock market comprises several angles. Out of the series of annual returns, the number of years in which the market recorded abnormally high and abnormally low returns is calculated and compared with the US and German markets, in order to do an international benchmarking. The analysis of this series also allows the assessment of on whether there is a concentration of extreme rates of return in some sub-periods and on whether there is a trend towards less frequent extreme returns throughout the 36 year period.

The **skewness** and the **kurtosis** of the distribution of daily returns are measured and **tests of normality** are performed. Through moving (time) windows, the evolution of these statistics and their convergence is assessed, contributing to a better understanding of the dynamics of the market's volatility.

The treatment of the data also enables the creation of a **histogram of annual returns**, contributing to a better perception of the market's evolution.

The **mean** and the **standard deviation** of the **annual return** on the Portuguese stock market in the 1977-2012 period are estimated and their evolution throughout different sub-periods of time is assessed. These indicators are also compared with the mean and the standard deviation of the annual return on other instruments such as Portuguese government bonds and treasury bills and on the German and North American equity markets. The analysis of the moving window of the annualised standard deviation of 52 and of 156 weekly returns of the Portuguese stock market and its comparison with the German and North American stock markets complements this point.

From here, and using the estimations made for the equity market risk premium, the **Sharpe ratio** for the Portuguese market is estimated, which helps to understand how well the Portuguese stock market return has compensated for the risk taken and how this relation compares with other reference markets.

The analysis also covers the **distribution of daily changes** of the Portuguese stock market in the 1977-2012 period and an assessment of on whether there is a trend in the evolution of that distribution, namely towards an increasing concentration of observations in narrower daily change ranges (between -1% and +1% or between -2% and +2%) and towards patterns seen in other markets. The **auto-correlation of returns** (daily and annual returns) is assessed for Portugal and for other markets through moving windows and **Variance Ratio tests** are also carried out.

The use of moving windows for the assessment of several indicators supports the identification of key moments and crucial periods of time that shaped the market and oriented its evolution towards some patterns.

4.3. Country-Specific Risk and Correlation of Returns

The evolution of Portugal's country-specific risk is analysed through the assessment of the **correlation of returns between Portugal and other reference markets**. Using daily returns (more than 8000 daily sessions) of representative indexes for the 1977-2012 period - PSI-20 for Portugal (recalculated for the 1977-1992 period, as discussed in 4.1. above), DAX for Germany and S&P500 for the United States of America –, correlation is measured considering **moving windows of 500 sessions** (approximately two years of daily sessions). This analysis takes into consideration only the days in which the Portuguese stock market was open – this is particularly important for the 1977-1989 period, as only in May 1989 the Portuguese stock exchange started operating five days a week (unlike the German and North American markets, that in 1977 already operated from Monday to Friday).

The graphic representation of this analysis highlights the moments when the degrees of correlation changed more significantly.

The correlation of daily returns for Portugal and for other markets in the 1989-2012 period (almost 6000 daily sessions) and in the two sub-periods of 1989-2000 and 2001-2012 is also estimated, with the aim of getting a confirmation of the evolution trend suggested by the previous analysis. For this specific analysis, correlations with the **French** and the **British** stock markets, apart from the **German** and the **North-American** markets, are also estimated in order to verify on whether the evolution trend for Portugal is in line with the evolution trend recorded by other markets, ie on whether the higher **integration** of the Portuguese market is accompanied by a higher integration between the other main markets and on whether the gap (in the degree of integration) is narrowed.

The weightings of the **systemic and country-specific risks** on the performance of the Portuguese stock market are also estimated through **multiple regressions** of annual returns (considering moving periods of 12 years) and of monthly returns (considering moving periods of 36 months) for the Portuguese market and for the German and US markets.

5 – Results Analysis

5.1. Return and Risk Premium

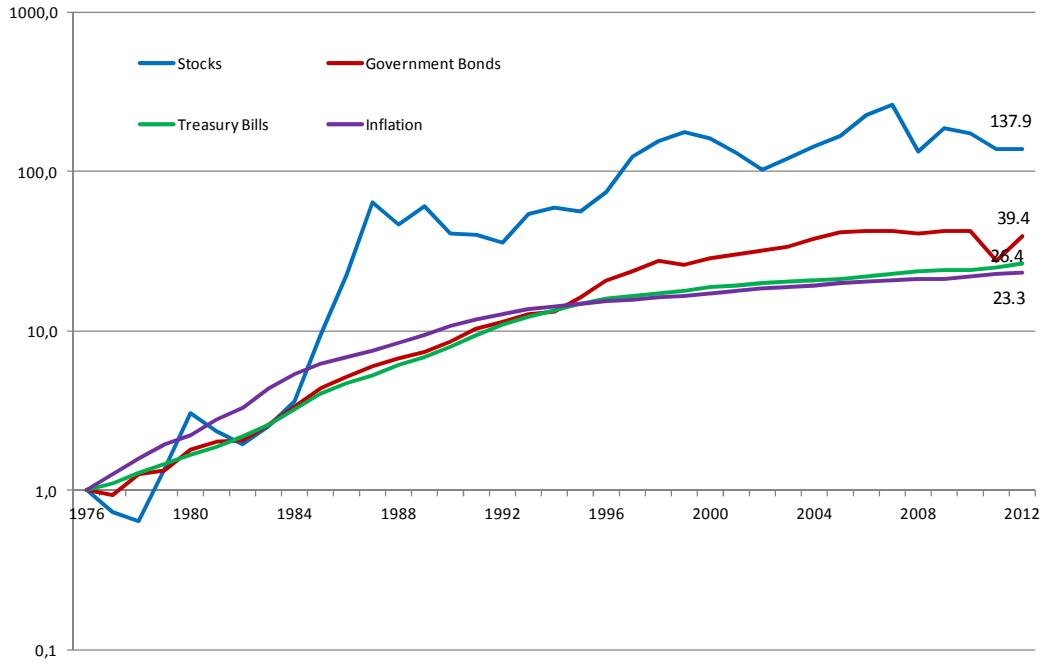
5.1.1. Stock Market Return and Comparison with Benchmarks

An investor that invested 1,000$00 (approximately €4.99) in April 1977 in a portfolio of shares representative of the Portuguese market at the time and that periodically readjusted the portfolio to make sure it represented the market and systematically reinvested all the dividends received, would have seen his portfolio worth 137,900$00 (€688) at the end of September 2012.

If, instead, that same investor had channelled his 1,000$00 savings into the acquisition of a long term government bond in early 1977, receiving the corresponding interest during the year and selling the bond in December 31, 1977 at market price, reinvesting the proceeds from that sale in the acquisition of another representative long term bond and repeating this procedure every year by 2012, his portfolio would be worth 39,400$00 (€197) in September 2012.

If the investor had invested the 1,000$00 amount in risk-free instruments - money market instruments by 1985 and treasury bills from 1986 onwards (treasury bills were created in 1985), his portfolio would be worth 26,400$00 (€132) in September 2012.

Figure 5 – How an investment of PTE 1 on January 1st, 1977 would have grown by 2012, assuming reinvestment of dividends and interests



Sources: Euronext Lisbon, Bloomberg, IGCP, Banco de Portugal

The relative performance over the last 36 years of Portuguese equities vis-à-vis government bonds and treasury bills is in line with the hierarchy of risk inherent to each category. However, we can see from Figure 5 above that a substantial appreciation of the stock market was achieved in the first third of the period under analysis: in December 1987, the stock portfolio was already worth €63,900, almost half the overall appreciation achieved between

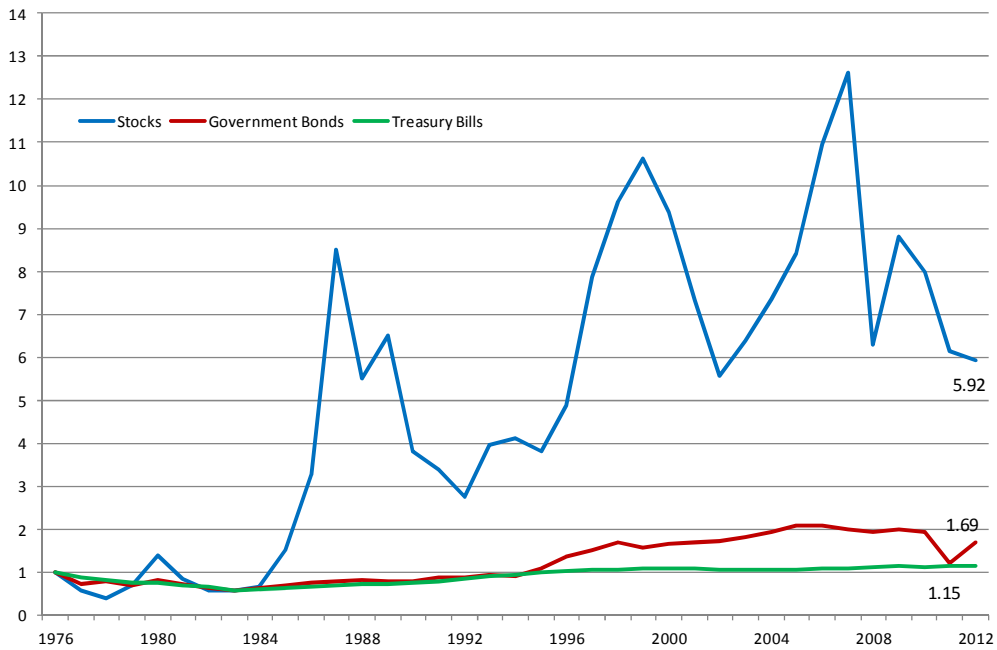
1977 and September 2012, reflecting a 64.9% average annual rate or return (or a 46% compounded annual rate of return), well above the 6.8% average annual rate of return achieved in the subsequent 25 years (3.1% compounded annual rate of return between 1987 and 2012). Although less pronounced, in 1999 and in 2007 the Portuguese stock market also achieved important peaks.

The performance of the Portuguese stock market (and of the government bonds) in the 1977-2012 period is less "impressive" when measured in real terms. Portugal experienced two digit inflation rates by 1990, with annual rates (yoy inflation as at December) remaining above 20% in six years and reaching a peak of 33.8% in 1983 (see figure 2A in the Annex).

Redoing the previous exercise in real terms, an initial investment of 1 in January 1977 would be worth 5.92, 1.69 or 1.15 in September 2012 (nearly 4.2% of the nominal amount previously estimated), had it been channelled into stocks, government bonds or treasury bills, respectively. Inflation therefore clearly had an important impact on the price of financial assets and on nominal rates of return.

The inflation adjusted performance chart further enhances the three important peaks recorded in 1987, 1999 and 2007, with the former not appearing anymore much more pronounced than the other two peaks, which confirms that the extreme rise recorded by 1987 was to a large extent inflation driven. The chart also suggests a strong negative auto-correlation of returns.

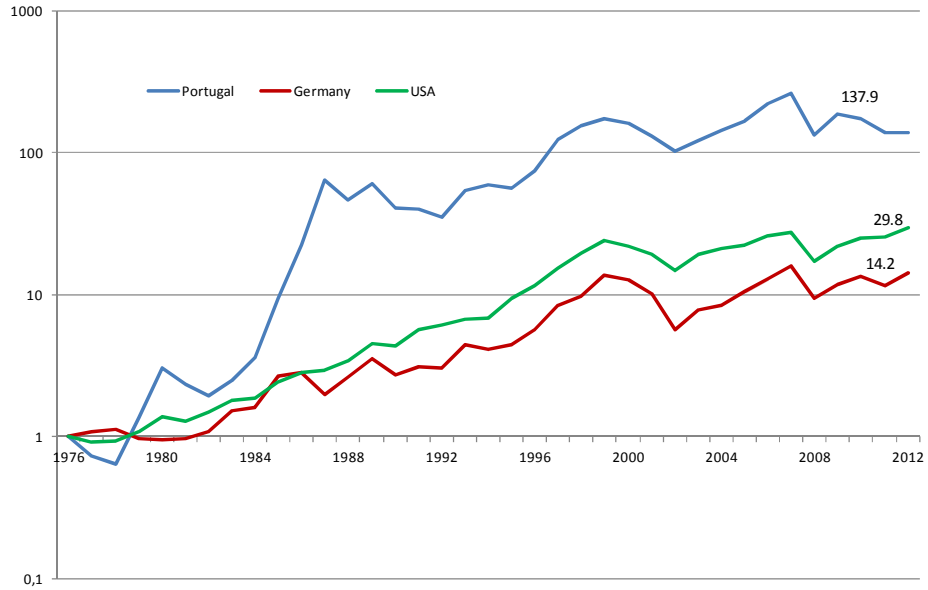
Figure 6 – How an investment of PTE 1 on January 1st, 1977 would have grown in real terms by 2012, assuming reinvestment of dividends and interests



Sources: Euronext Lisbon, Bloomberg, IGCP, Banco de Portugal

Comparing the performance of the Portuguese stock market with the performance of the German stock market (we are using the DAX index, as this is a total return index) and the performance of the US stock market (we are using the S&P Total Return index), we can see that Portugal clearly outperformed these markets in nominal terms in the 1977 – 2012 period.

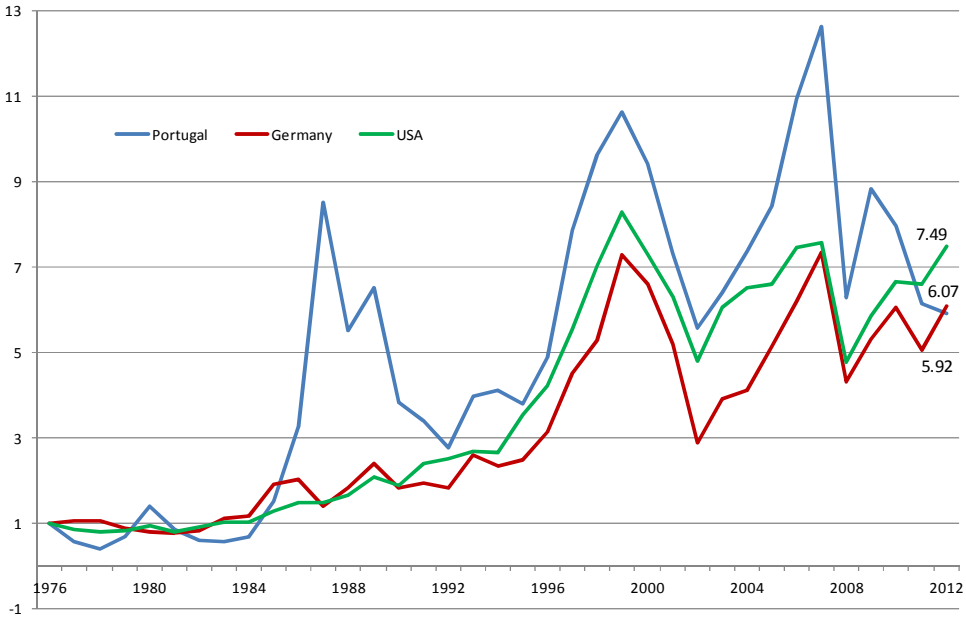
Figure 7 – How an investment of 1 on January 1st, 1977 would have grown by 2012
Nominal Terms, Local Currency



Sources: Euronext Lisbon, Bloomberg

Adjusting each index's evolution by the corresponding country's inflation - in the 1977-2012 period the German annual inflation averaged 2.4% and the US inflation averaged 4.0%, which compare with 9.5% for Portugal -, the overall performances of these three markets become much more aligned, with Portugal's overall performance standing slightly below Germany's: The US market posted a 649% accumulated return in real terms while the German market achieved 507% and Portugal 492%.

Figure 8 – How an investment of 1 on January 1st, 1977 would have grown by 2012
Inflation Adjusted Terms, Local Currency



Sources: Euronext Lisbon, Bloomberg

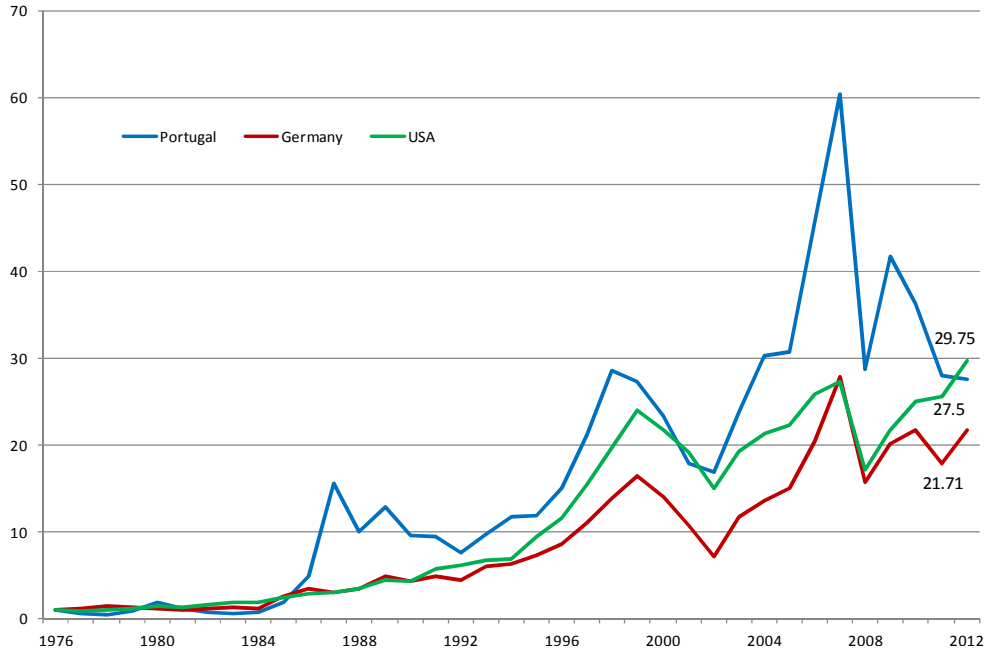
Given Portugal's decoupled performance vis-à-vis Germany and the USA, figure 8 also suggests that in the 1985-1992 sub-period country specific risk factors weighted more than systematic risk factors on the evolution of the Portuguese market.

If the end result of the market's performance in the 1977-2012 period measured in real terms is relatively aligned (between Portugal and Germany the difference is only 2.4%), the slope and the swinging movements of the performance lines throughout the 36 year period suggest nevertheless a much more volatile behaviour of the Portuguese stock market vis-à-vis Germany and the US, with Portugal presenting much more pronounced peaks.

Adjusting the evolution of the three stock markets in the 1977-2012 period to the same currency - the US Dollar, for the case -, we can see that the Portuguese market's accumulated appreciation stood below the US market's and above the German market's, although Portugal recorded a better accumulated performance than these two markets between 1984 and 2011, with the exception of year 2001.

A comparative analysis suggests again a higher volatility in the evolution pattern of the Portuguese stock market vis-à-vis other markets. The aforementioned three peaks are still visible in this chart, but this time with the 1999 peak less evident due to the 15% depreciation of the Euro against the US Dollar in that year and the 2007 peak more clear due to the 12% appreciation of the Euro against the US Dollar in that year.

Figure 9 – How an investment of 1 on January 1st, 1977 would have grown by 2012 in USD Terms



Sources: Euronext Lisbon, Bloomberg, Banco de Portugal

Given the sharper rises and the deeper (subsequent) downwards adjustments, the chart also suggests that the Portuguese market is a higher Beta market when compared with the other two markets.

5.1.2 Equity Market Risk Premium

Between 1977 and 2012, the Portuguese stock market (arithmetic) average annual return amounted to 24.6% in nominal terms. This compares with an 11.7% average return on government bonds, therefore corresponding to a 12.9% premium on long term Government debt.

Figure 10 – Average Rates of Return on Portuguese Treasury Bills, Government Bonds and Stocks in the 1977 – 2012 Period

	Average Annual Rate of Return		Average Risk premium
	Nominal	Real	(Extra return vs. T. bills)
Treasury bills	9,77%	0,52%	0,00%
Government bonds	11,70%	2,37%	1,93%
Stocks	24,56%	14,00%	14,79%

Sources: Euronext Lisbon, Bloomberg, IGCP, Banco de Portugal

The estimation of the Portuguese equity market risk premium (on treasury bills) for the 1977-2012 period points to a 14.79% level, which is well above the existing estimates for risk premiums in main stock markets. As it will be seen later in this paper, the estimated risk premium of the Portuguese stock market changes significantly when smaller sub-periods within the 1977-2012 horizon are considered, with the year of 1988 being a major turning point.

Figure 11 – Annual Risk Premiums (vs. Treasury Bills)

	Historical Equity Risk Premiums (%)
Portugal 1977-2012	14,79
Other markets 1900-2005	
Germany	9,07
USA	7,41
Australia	8,49
Belgium	4,99
Canada	5,88
France	9,27
Italy	10,46
Japan	9,84
Netherlands	6,61
Spain	5,46
Switzerland	5,29
United Kingdom	6,14

Sources: Euronext Lisbon, Bloomberg, IGCP, Banco de Portugal, Stephen A. Ross et al

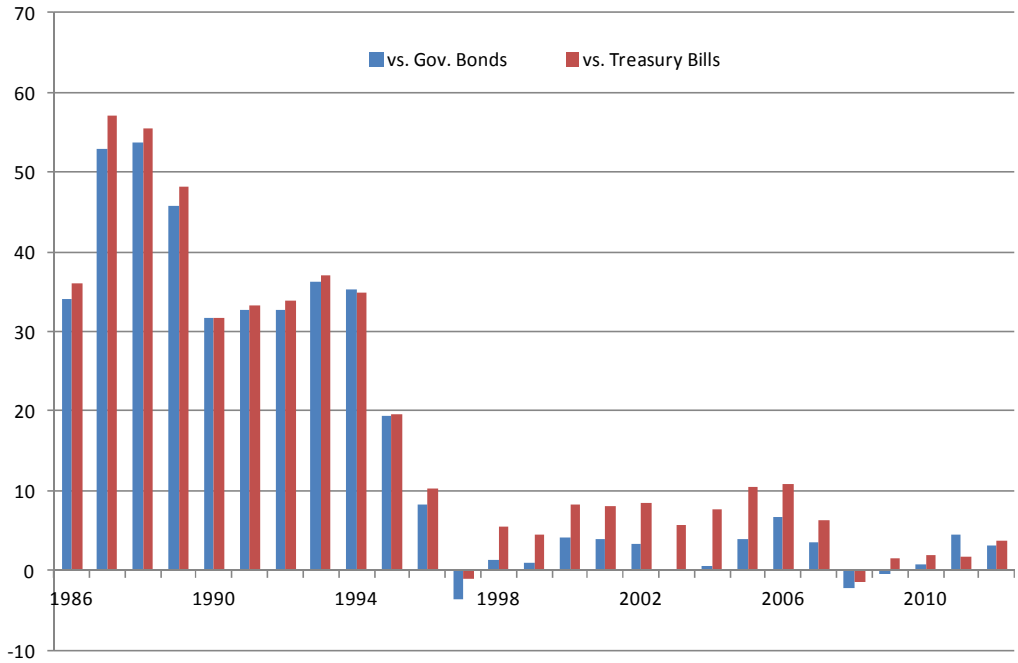
The available estimates of risk premiums in developed markets based on very long series (more than 100 years) point to levels between 5% and 10%. The value estimated for Portugal doubles the existing estimates of risk premium for the US market and surpasses in more than 60% the projections for the German market.

The risk premium estimated for the Portuguese equity market in 1977-2012 is conditioned by the smaller time horizon (36 years) considered in the calculation, which make its estimation more sensitive to the extremely high annual returns recorded in some years of the first third of the period: between 1977 and 1987 there were 5 years with a market return above 100%.

The calculation of a 10 year moving average of the market risk premium using the equity market annual return and treasury bills annual return for the preceding 10 years (Figure 12) helps us to confirm this effect and to detect an evolution pattern – though due to the small number of years being considered in each calculation the projected risk premium resulting from this calculation is not relevant in itself.

The moving average of the market risk premium (on government bonds and on treasury bills) highlights the abnormal returns achieved by 1987 that translated into a projected risk premium of more than 30% by 1984, but shows a clear downward trend since 1986. The moving average becomes very sensitive to the market correction recorded in the 1988-1992 period, as well as to the sharp downwards adjustment the market has undergone since 2008, which, combined with the Republic of Portugal's rising borrowing costs, translated into low or even negative values in recent years.

Figure 12 – 10 year Moving Average of the Risk Premium of the Portuguese Stock Market



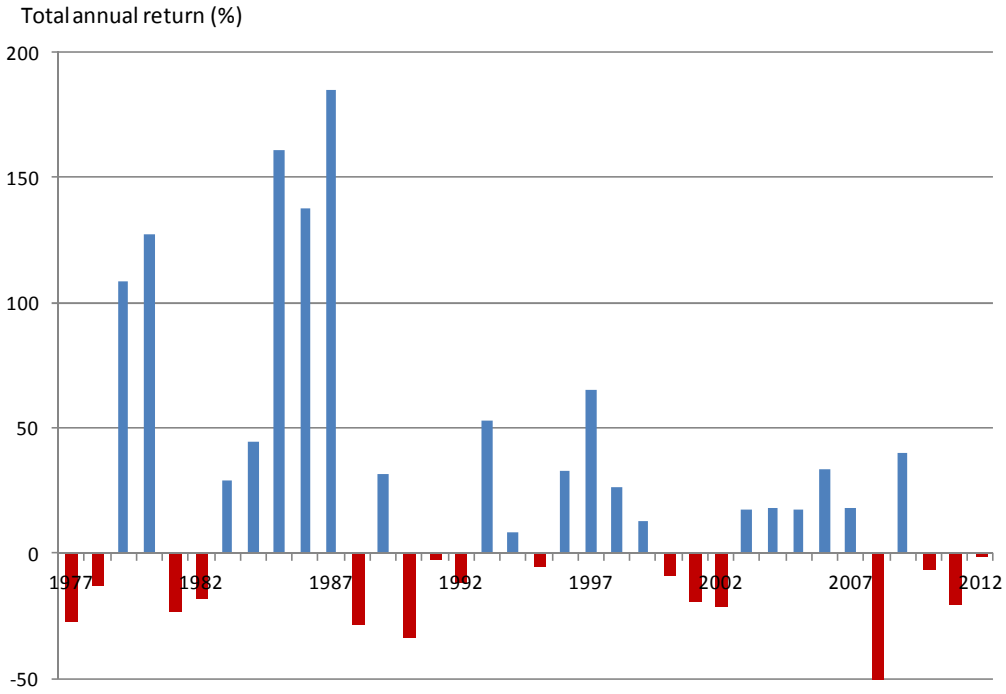
Sources: Euronext Lisbon, Bloomberg, IGCP, Banco de Portugal

Clearly, from the previous chart we can not elaborate much on the right level for the Portuguese equity market risk premium, but we can perceive a downwards trend and a convergence towards the levels estimated for other developed markets out of longer series.

5.2. Risk

The figure below shows the Portuguese stock market annual return since 1977. Over this period, the market appreciated more than 100% (per year) in five years and never fell more than 50% in a single year. The stock market recorded negative returns in 16 out of the 36 years under analysis, which compare with five years of negative returns for investments in Government bonds (figure 3A in the Annex).

Figure 13 – Year-by-Year Total Returns on Portuguese Stocks



Sources: Euronext Lisbon, Bloomberg

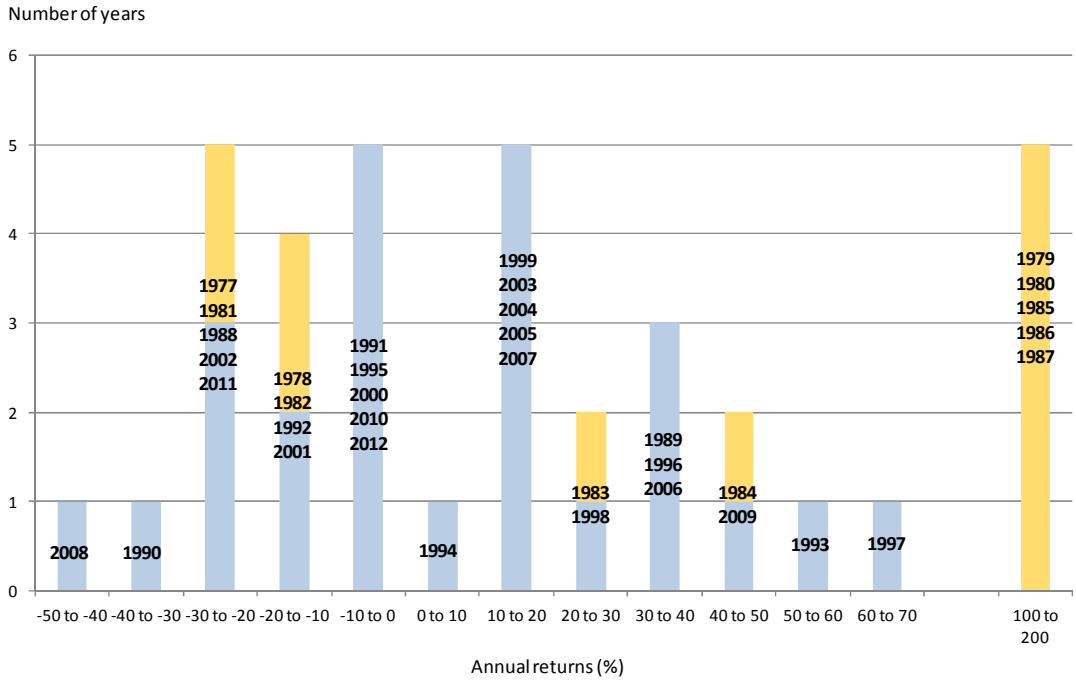
The comparison of the number of years with extremely high or extremely low annual returns recorded by the Portuguese stock market and by the German and North-American stock markets (figures 4A and 5A in the Annex) suggests at a first glance a much higher volatility for the Portuguese market. Indeed, over this 36 year period, the US market did not record a single annual return beyond +40% or -40% and Germany only four times surpassed those boundaries, which compares with 10 times for Portugal (a detailed analysis of skewness and kurtosis moments is made in a following section of this sub-chapter).

Between 1977 and 2012, the US market recorded 4 years with annual returns between 30% and 40% and one year with an annual return between -30% and -40%, while Germany recorded 8 years with returns above 30% - and out of these, only one with a return above 50% (1985, with a 66% annual return) – and two years with a negative return beyond -30% (2002 and 2008, with -44% and -40%, respectively).

Interestingly, excluding the 5 years with annual returns above 100%, all of them concentrated in the first eleven years of the period under analysis, only twice the Portuguese stock market provided an annual return on top of 50% (53.1% in 1993 and 65.2% in 1997). It is also worth mentioning that, similarly to the US market, 2008 was the worst year for Portugal, with a -49.7% return (in the case of Germany, 2002 was the worst year).

The figure below plots the annual returns on the Portuguese stock market in 1977-2012. Apart from the already mentioned five annual rises above 100% between 1977 and 1987, it is also worth noting that in only one year, out of those with a positive performance, the stock market went up less than 10% and that it rose between 30% and 70% as many times (7 times) as it did between 10% and 30%. Under the 36 years under analysis, the Portuguese market recorded 16 years with negative returns, while the US and Germany only seven and eleven times (respectively) saw a year ending in the red.

Figure 14 – Histogram of the Annual Rates of Return on the Portuguese Stock Market in the 1977 – 2012 Period

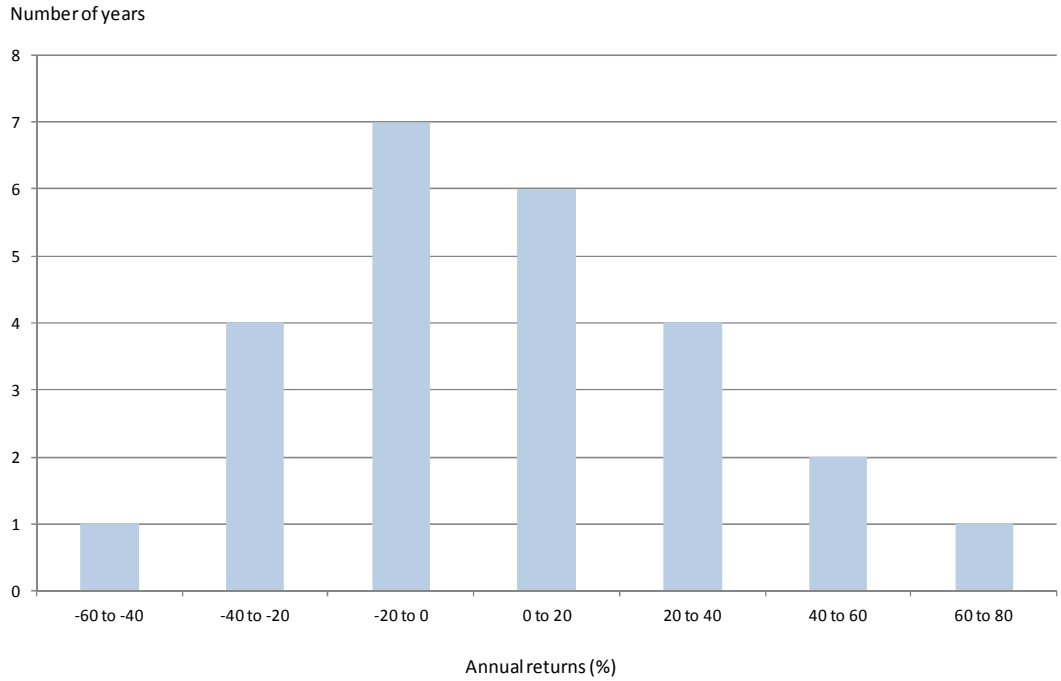


Sources: Euronext Lisbon, Bloomberg

The (wide) distribution of frequencies suggests again high levels of volatility. Removing from the chart the 11 years between 1977 and 1987 and considering wider intervals (0 to 20% instead of 0 to 10%), we get a more even distribution, positively skewed.

The comparison of the two sub-periods uggests that there was an evolution of the Portuguese stock market towards less extreme annual returns and consequently lower levels of volatility. If the first idea can be directly observed, the analysis of average returns and standard deviations in different sub-periods of time does not allow us to confirm the second idea.

Figure 15 –Histogram of the Annual Rates of Return on the Portuguese Stock Market in the 1988 – 2012 Period



Sources: Euronext Lisbon, Bloomberg

In the 1977 – 2012 period the market's annual **return** averaged 24.56% and the **standard deviation** (of the annual returns) amounted to 55.98%. However, if we consider two sub-periods, namely 1977-1988 and 1989-2012, we reach a 57.16% average annual return and a 81.54% standard deviation (standard deviation equivalent to 1.42x the mean) for the former period and an 8.26% average annual return and a 27.51% standard deviation for the latter (standard deviation equivalent to 3.33x the mean).

Figure 16 –Annual Average Returns, Standard Deviations and Variances for the Portuguese Market in the 1977 – 2012 period

	Average (%)	Standard Deviation (%)	Variance
Treasury Bills	9,77	6,72	45,21
Government Bonds	11,70	14,29	204,18
Stocks	24,56	55,98	3133,48
Inflation	9,47	8,88	78,81
Stocks (1977-1988)	57,16	81,54	6648,63
Stocks (1989-2012)	8,26	27,51	756,88
German Stocks (1977-2012)	10,68	25,11	630,60
US Stocks (1977-2012)	11,23	16,60	275,60

Sources: Euronext Lisbon, Bloomberg, IGCP, Banco de Portugal

The previous table confirms the expected hierarchy of return / risk for stocks, government bonds and treasury bills in Portugal in the 1977-2012 period. It also confirms the higher average (nominal) return of the Portuguese market vis-à-vis Germany and the USA, and an apparently higher dispersion of returns. Calculating the "Standard Deviation / Mean" ratio for each market, we learn nevertheless that Portugal's ratio (2.28x) is above the US's (1.48x) and slightly below Germany's (2.35x). This ratio is the inverse of the Sharpe ratio. Its higher level when compared with other markets indicates a higher volatility of the Portuguese stock market for equivalent levels of return.

The **Sharpe ratio** for Portugal in the 1977-2012 period is estimated at 0.26, below most of the developed markets presented in Figure 17, but in line with the ratio calculated for Spain for the long 1900-2005 period and above Belgium's.

The calculations for the shorter 1989-2012 period result in a much lower Sharpe ratio for the Portuguese market (0.05). The standard deviation of the Portuguese stock market's annual return comes down when this period is considered, but so does the estimated risk premium (calculated on treasury bills), reflecting the combined effect of a poor overall stock market performance and relatively higher public debt' interest rates.

Figure 17 – Annual Risk Premiums (vs. Treasury Bills) and Sharpe Ratios

	Historical Equity Risk Premiums (%)	Standard Deviation (%)	The Sharpe Ratio
Portugal 1977-1988	40,69	81,54	0,50
Portugal 1989-2012	1,44	27,51	0,05
Portugal 1977-2012	14,79	55,98	0,26
Other markets 1900-2005			
Germany	9,07	33,49	0,27
USA	7,41	19,64	0,38
Australia	8,49	17,00	0,50
Belgium	4,99	23,06	0,22
Canada	5,88	16,71	0,35
France	9,27	24,19	0,38
Italy	10,46	32,09	0,33
Japan	9,84	27,82	0,35
Netherlands	6,61	22,36	0,30
Spain	5,46	21,45	0,25
Switzerland	5,29	18,79	0,28
United Kingdom	6,14	19,84	0,31

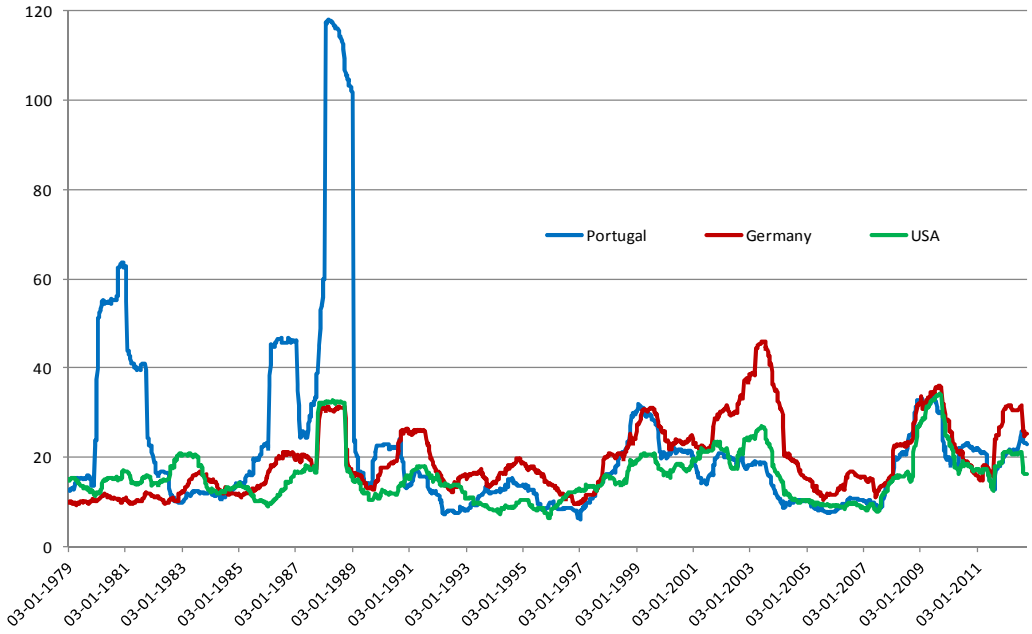
Sources: Euronext Lisbon, Bloomberg, IGCP, Banco de Portugal, Stephen A. Ross et al

Figure 18a presents the evolution of the annualised **standard deviation** of the preceding 52 weekly returns of the Portuguese, German and North American stock markets since 1978 (calculations starting with 1977 figures).

Only standard deviations are being considered (the average return is not displayed), which prevents broader conclusions on the evolution of the risk / return pattern of the Portuguese

stock market vis-à-vis these other markets. Nevertheless, the chart confirms the high volatility of the Portuguese market in the 1977-1987 period and seems to suggest a smoother pattern and an evolution more in line with the two benchmarks in the following years. In December 1980, the annualised standard deviation for the Portuguese market amounted to 62%, which compared with 10.5% and 16.9% for Germany and for the US market, respectively. In 1987 (year end) the standard deviation (for the Portuguese market) reached 59% and in 1988 it attained 102%. Germany and the USA also experienced increasing volatility in those years (standard deviations of 31.4% and 32.0% in 1987 and 16.6% and 15.6% in 1998, for Germany and the USA, respectively), but not as sharp as Portugal's.

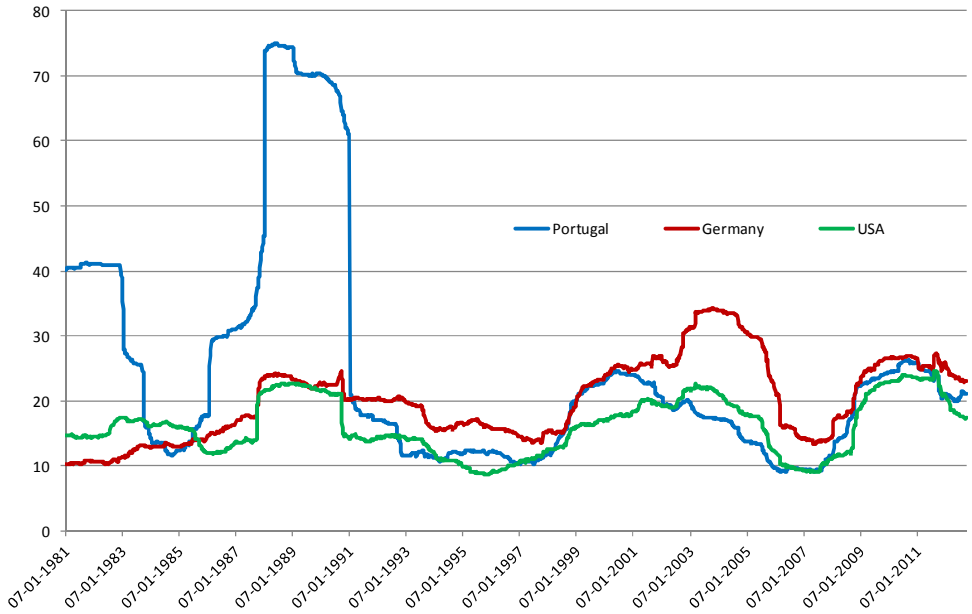
Figure 18a – Annualised Standard Deviation of the Preceding 52 Weekly Changes in the Portuguese, German and US Stock Markets (1978-2012)



Sources: Euronext Lisbon, Bloomberg

From 1989 onwards, the standard deviation of the Portuguese market evolved in line with the German and the US markets. There were periods of enhanced volatility in 1999, 2002, 2009 and 2012, but Portugal's standard deviation never surpassed the 40% level. Actually, it was the German market that recorded the highest levels of volatility in those peak moments.

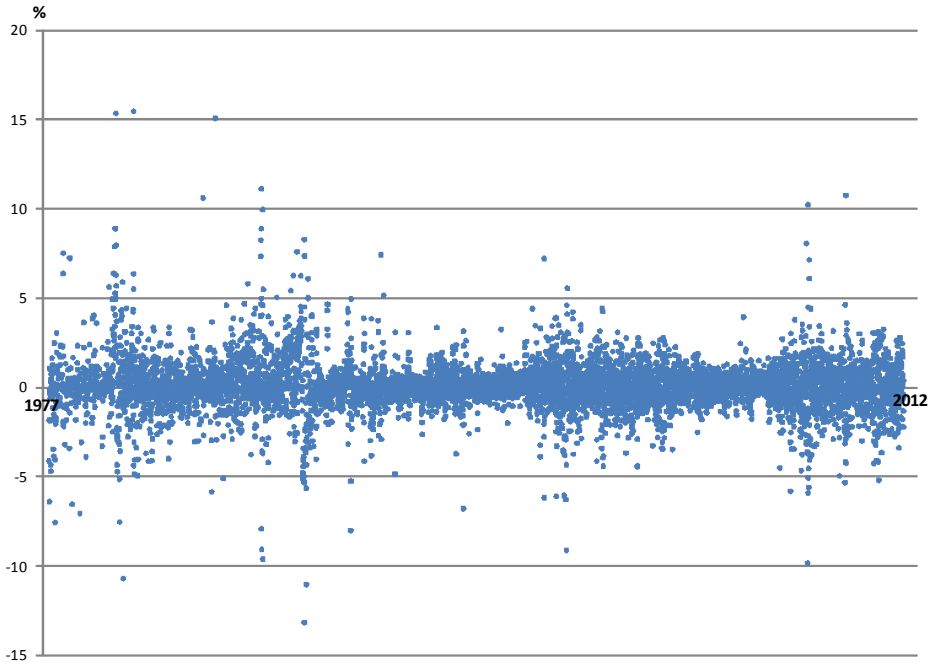
Figure 18b – Annualised Standard Deviation of the Preceding 156 Weekly Changes in the Portuguese, German and US Stock Markets (1978-2012)



Sources: Euronext Lisbon, Bloomberg

Figure 18b considers the wider window of 156 weeks, which corresponds to approximately 3 years, and confirms the peaks of volatility of the Portuguese market in 1978-1981 and in 1986-1990. It also confirms Portugal's lower volatility (in comparative terms) since 1991, always below Germany's (with only some punctual exceptions) and evolving very much in line with the two reference markets.

Figure 19 - Daily Price Changes in percent terms for the Portuguese Stock Market in the 1977 – 2012 Period

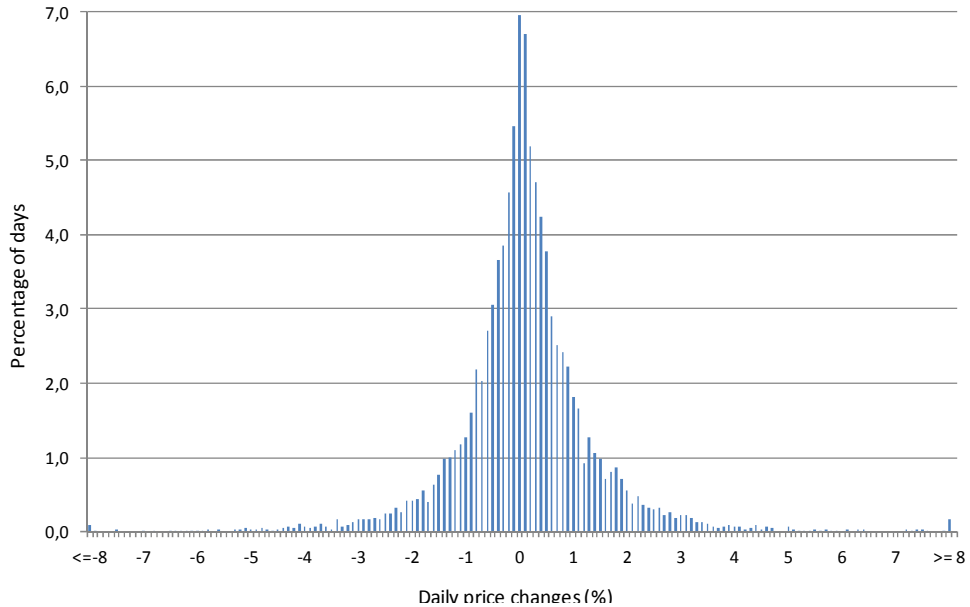


Sources: Euronext Lisbon, Bloomberg

Figure 19 plots the distribution of the daily price changes of the Portuguese stock market (PSI-20 index) in the 1977-2012 period and suggests a bigger dispersion in the first third of the period and a higher concentration in the remaining years.

The graphic representation of the distribution of the daily changes in the 1977-2012 period (using ranges of 0.1%) is shown in figure 20.

Figure 20 - Daily Price Changes for the Portuguese Stock Market in the 1977 – 2012 Period



Sources: Euronext Lisbon, Bloomberg

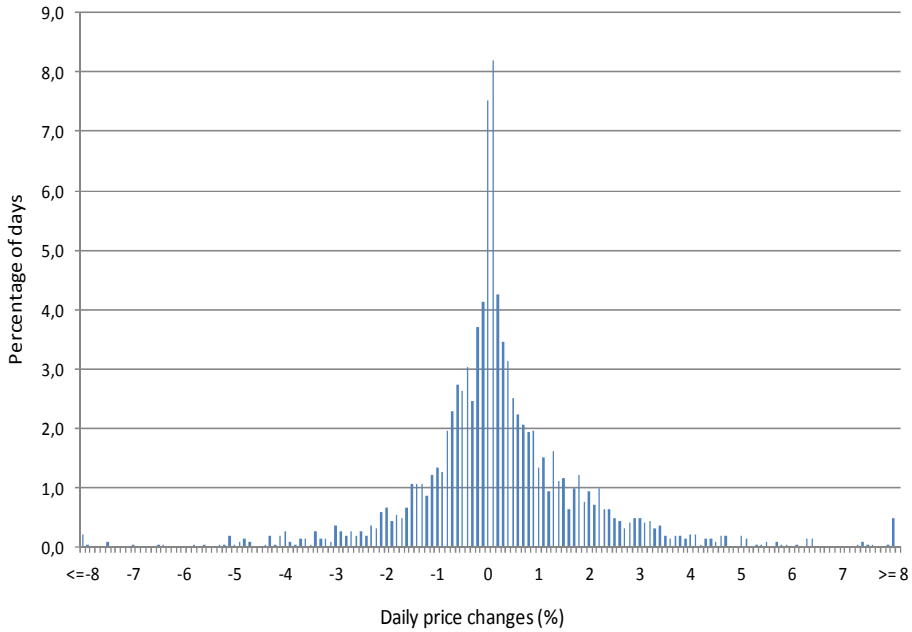
Splitting this period of time in two sub-periods, 1977-1988 and 1989-2012, the higher dispersion of the earlier period is confirmed. In fact, in the 1977-1988 sub-period, 35.8% of the market sessions recorded gains above 1% or losses of more than 1%, and 16.8% of the sessions recorded gains above 2% or losses of more than 2%, which compare with 22.5% and 6.3%, respectively, in the 1989-2012 period.

Interestingly, the 1977-1988 period also recorded a higher percentage of daily changes between -0.1% and +0.1%: 15.7% vs. 13.0% (this may be partly explained by the lower liquidity and reduced market depth of the earlier period).

The estimation of **quartiles** for the two sets of observations confirms the higher dispersion of daily returns in the 1977-1988 period: first quartile of -0.5371% and third quartile of 0.8097%, which compare with a first quartile of -0.4537% and a third quartile of 0.4978% in the 1989-2012 period (second quartile of 0.00613% in 1977-1988 vs. 0.00624% in the second period).

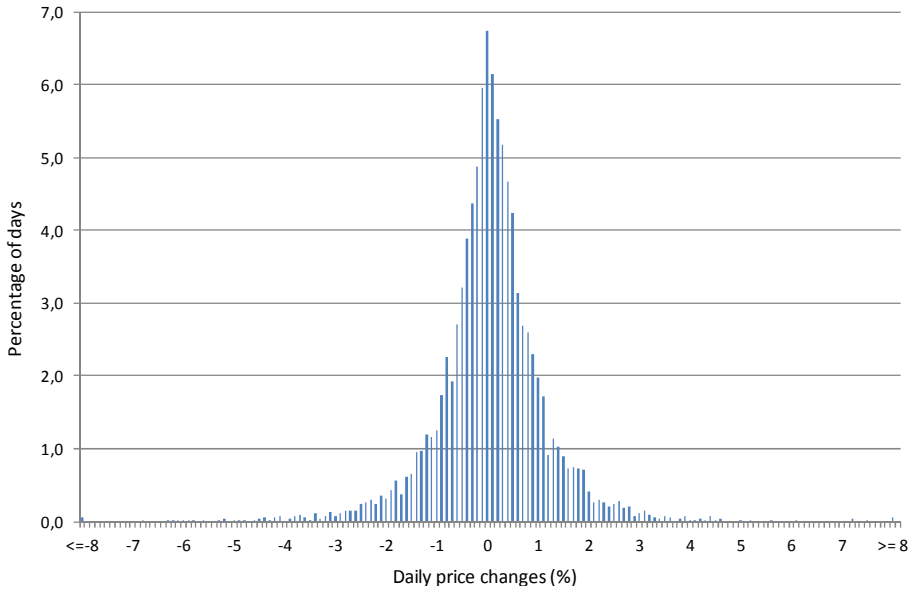
Calculations of kurtosis and skewness statistics and a more comprehensive analysis are presented later in this sub-chapter.

Figure 21 - Daily Price Changes for the Portuguese Stock Market in the 1977 – 1988 Period



Sources: Euronext Lisbon, Bloomberg

Figure 22 - Daily Price Changes for the Portuguese Stock Market in the 1989 – 2012 Period



Sources: Euronext Lisbon, Bloomberg

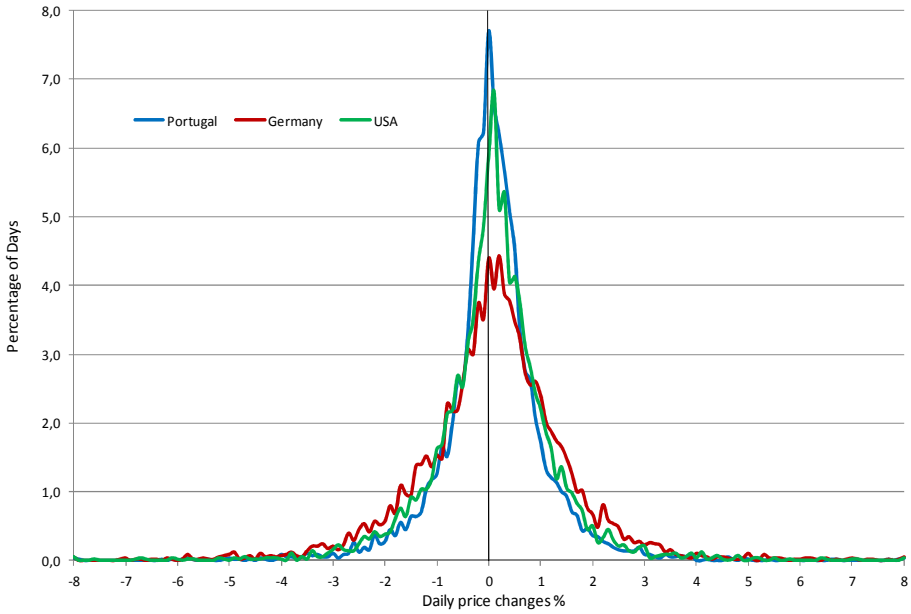
The calculation of each period's **mean** and **standard deviation** confirms the higher dispersion and the relatively higher average return of the first period: mean of 0.184% and standard deviation of 1.8706% in 1977-1988 vs. mean of 0.0084% and standard deviation of 1.1088% in the 1989-2012 period. These values translate into coefficients of variation of 10.17 for 1977-1988 and of 132.24 for 1989-2012.

The analysis of **daily performances** of **total return indexes** for Portugal (PSI Geral) , Germany (DAX) and the USA (SPXT) (figure 23) in the 1989-2012 period shows Portugal with a higher percentage of days with changes between -0,5% and +0,5%, 52%, well above Germany (34%) and the USA (43%). This could suggest lower volatility for the Portuguese market, but once

again this has to be dealt in combination with market returns, which, as previously seen, remained below other markets.

In fact, between 1989 and 2012, the Portuguese stock market daily return averaged 0.0240% and the standard deviation amounted to 1.04425%, below the 0.03988% average return and the 1.4952% standard deviation estimated for the German market in the same period and also below the 0.04398% average daily return and the 1.1778% standard deviation estimated for the US market. Estimating coefficients of variation out of these total return indexes, we get 43.46 for Portugal, 37.49 for Germany and 26.78 for the USA.

Figure 23 –Distributions of the Daily Changes of Total Return Indexes for the Portuguese Stock Market (PSI Geral Index) and for Other Major Markets in 1989 – 2012



Sources: Euronext Lisbon, Bloomberg

The estimation of the **auto-correlation** between annual returns leads to a higher statistic for Portugal vis-à-vis other developed markets in the 1977-2012 period. In fact, Portugal presents a relatively high 0.347 correlation, which compares with negative and much lower - in absolute terms – correlations for the German and North American markets, with the US market presenting an almost nil auto-correlation.

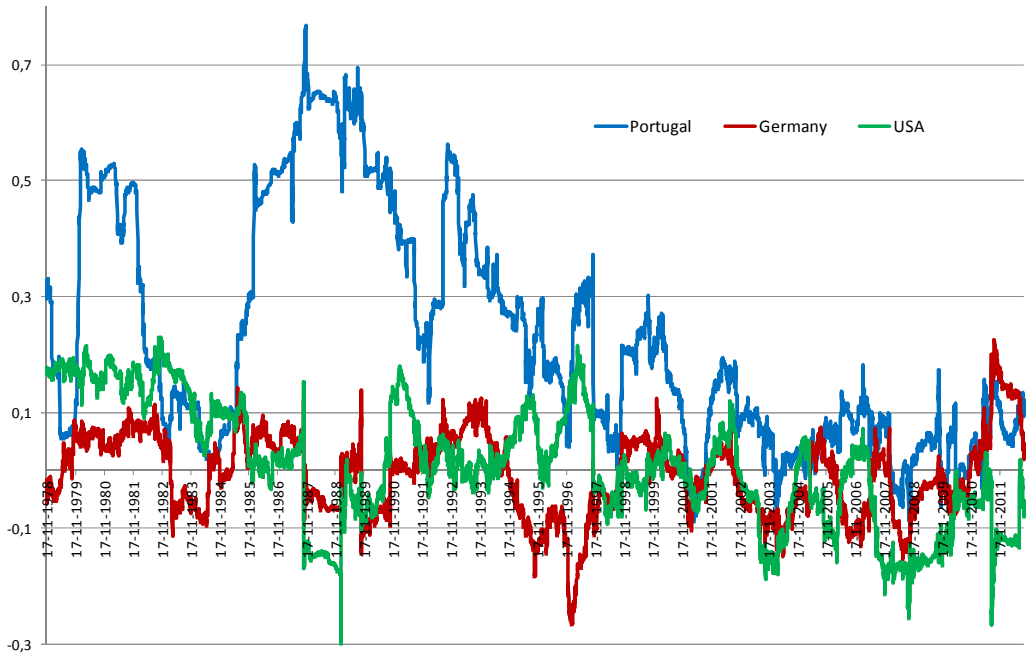
Figure 24 – Auto-correlation of Annual Returns (Year t vs. Year t-1) in the 1977 – 2012 Period

	Correlation Year t vs. Year t-1
Portugal	0,347
Germany	-0,101
USA	-0,010

Sources: Euronext Lisbon, Bloomberg

The estimation of the auto-correlation of daily returns considering moving windows of 250 sessions (figure 25) confirms the higher auto-correlation of the Portuguese market in comparison with the German and the North American markets, specially in the 1979-1981 period and in the longer 1985-1997 period (when the auto-correlation surpassed the 0.50 level several times). However, it also suggests a downwards trend in the degree of auto-correlation for the Portuguese market, with the 0.30 level being achieved for the last time in October 1997, and the 0.2 level being achieved for the last time in May 2000. The auto-correlation of daily returns of the Portuguese stock market has typically remained below the 0.1 level since June 2003 (only punctually this level was breached), but systematically above the levels recorded in the German and US markets.

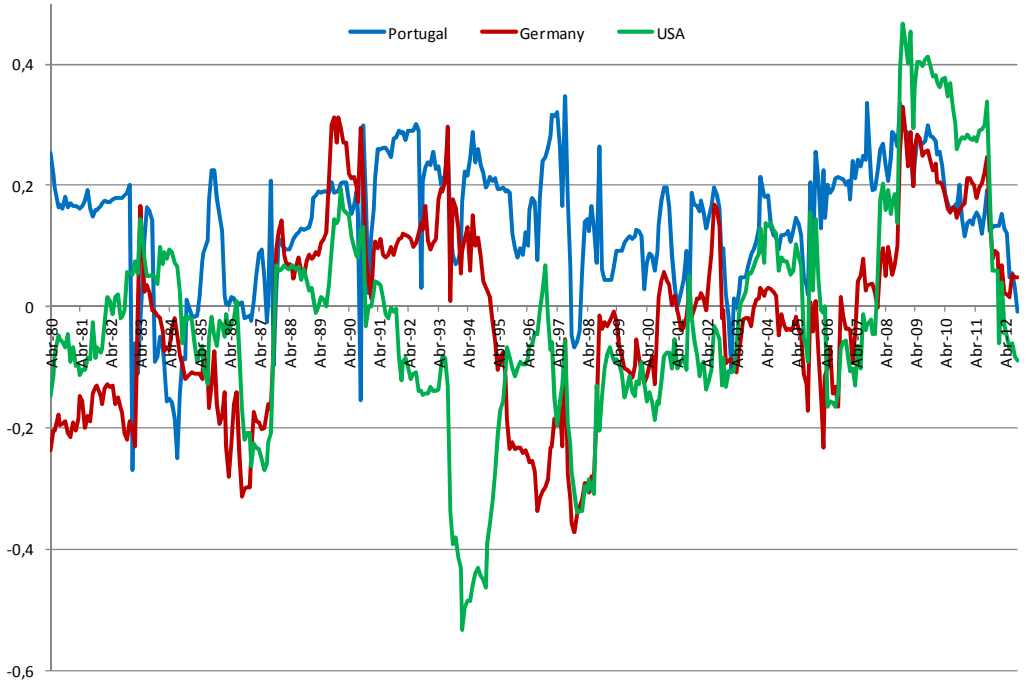
Figure 25 – Auto-correlation of Daily Returns (Day t vs. Day t-1)
Moving Average of the Preceding 250 Days



Sources: Euronext Lisbon, Bloomberg

The convergence or the downwards trend of the auto-correlation of returns for the Portuguese market is less visible when monthly returns are taken into consideration (figure 26, which presents 36 month moving windows). The higher correlation for the Portuguese market is visible, in particular in the 1994-2008 period, with the degree of correlation evolving near the 0.20 level.

Figure 26 – Auto-correlation of Monthly Returns (Month t vs. Month t-1)
Moving Average of the Preceding 36 Months



Sources: Euronext Lisbon, Bloomberg

Variance Ratio tests were performed for Portugal and for the two benchmark markets for the 1977-2012 period. The statistic for the Portuguese market comes out at 30x, well above the 18.05x level calculated for Germany and the 14.29x level estimated for the US market. It is also well above the 12x level that would be proper to see.

Considering three sub-periods of time (1977-1988, 1989-2000 and 2001-2012) we find that Portugal's highest statistic is recorded in the earlier sub-period, that it falls significantly in the second period but reverses this adjustment in the third period (figure 27). This pattern is very similar to Germany's, even though the statistic for the German market is closer to the 12x level. The US market undergoes a quite different evolution, with the statistic rising from one period to another, although the 14x statistic estimated for the whole period is the closest one to the 12x reference level.

Figure 27 – Variance Ratio Tests: Annual Return Volatility / Monthly Return Volatility

Variance of Annual Returns

	Portugal	Germany	USA
1977-1988	0,66476	0,06441	0,01527
1989-2000	0,08130	0,05341	0,02487
2001-2012	0,06920	0,07585	0,03813
1977-2012	0,31335	0,06306	0,02756

Variance of Monthly Returns

	Portugal	Germany	USA
1977-1988	0,02314	0,00253	0,00208
1989-2000	0,00465	0,00341	0,00154
2001-2012	0,00298	0,00453	0,00215
1977-2012	0,01044	0,00349	0,00193

Variance Ratios

	Portugal	**Germany**	**USA**
1977-1988	**28,73**	**25,43**	**7,36**
1989-2000	**17,47**	**15,65**	**16,11**
2001-2012	**23,24**	**16,73**	**17,75**
1977-2012	**30,00**	**18,06**	**14,29**

Sources: Euronext Lisbon, Bloomberg

Tests of normality were carried out for the distribution of the daily returns of the Portuguese market (and of the German and US markets) in the 1977-2012 period. The **skewness** of the Portuguese market is positive at 0.59, boosted by the 0.76 level recorded in the 1977-1988 sub-period. It compares with negative skewnesses for the German and US markets in the overall 1977-2012 period. The evolution of the degree of skewness throughout the three sub-periods of time shows some similarities amongst the three markets: skewness is negative in the three markets in the second sub-period and becomes positive in the three markets in the third sub-period. In absolute terms, skewness comes down systematically across the three markets. Although the statistic for the Portuguese market for the 36 year period is not in line with the other markets, the evolution across the three sub-periods is nevertheless consistent and convergent.

Kurtosis was estimated at 15.23 for Portugal (6.62 for Germany and 19.38 for the US market) in the 1977-2012 period, well above the level of 3 verified by normal distributions. The evolution of the statistic shows nevertheless a downwards convergence, which is also verified by the German market.

Figure 28 – Tests of Normality on the Distribution of Daily Returns - Results

Skewness

	Portugal	Germany	USA
1977-1988	0,76	-0,87	-2,38
1989-2000	-0,31	-0,49	-0,28
2001-2012	0,03	0,16	0,03
1977-2012	0,59	-0,19	-0,69

Kurtosis

	Portugal	Germany	USA
1977-1988	11,48	11,33	48,63
1989-2000	9,67	6,68	4,89
2001-2012	8,98	4,55	8,14
1977-2012	15,23	6,62	19,38

Bowman-Shelton Statistic

	Portugal	Germany	USA
1977-1988	6911,14	6750,87	195934,12
1989-2000	5582,53	1807,95	484,48
2001-2012	4460,71	313,23	3302,45
1977-2012	51671,38	4545,57	92493,93

The performance of the **Bowman-Shelton test** for normality leads to a test statistic for Portugal of 51,671, which stands well above the relevant significance point, leading to the rejection of the hypothesis of normality (similar conclusions to the German and US markets).

The real equity returns estimated by Dimson for 17 countries in the 1900-2005 period (2006) presented skewnesses of -0.14 and 1.47 and kurtosis of -0.35 and 5.65 for the USA and for Germany, respectively, confirming (in the case of the USA) a normal distribution.

In a previous analysis of the Portuguese market, Costa (1995) had already concluded that the distribution of daily changes for the PSI-20 (and BVL-30) index resembled normal distribution curves, but that it was not possible to confirm the normality of both curves - in the case of PSI-20, normality was affected by the "excessive" weight of the tails and, in the case of BVL-30, by the lack of symmetry around the mean. Curto (2004), in his analysis of the volatility of the Portuguese market vis-à-vis the German market (DAX) and the US market (DJIA), found somewhat asymmetric returns as a result of negative skewness, having also concluded – from the estimation of skewness and kurtosis statistics - that the three series showed strong departure from normality. Fernandes (2009) indicates the GARCH (1,1) model

with t-Student conditional distribution as the model that better explains the volatility pattern of the PSI-20 index.

The analysis of moving windows for the skewness and for the kurtosis of the Portuguese stock market and for other markets (Figures 29a and 29b) shows Portugal with systematically higher (in absolute terms) values by 1995 (skewness) and by 1988 (kurtosis), but confirms the country's convergence towards the other markets levels and its aligned evolution from those years onwards.

Figure 29a – Evolution of the Skewness of the Distribution of the Daily Returns of the Preceding 750 Sessions

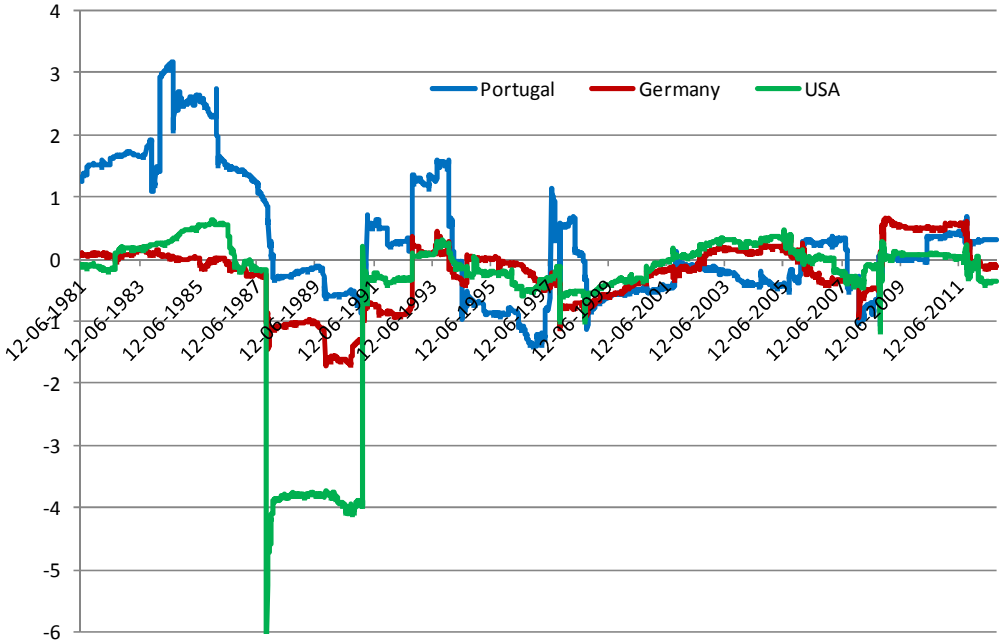
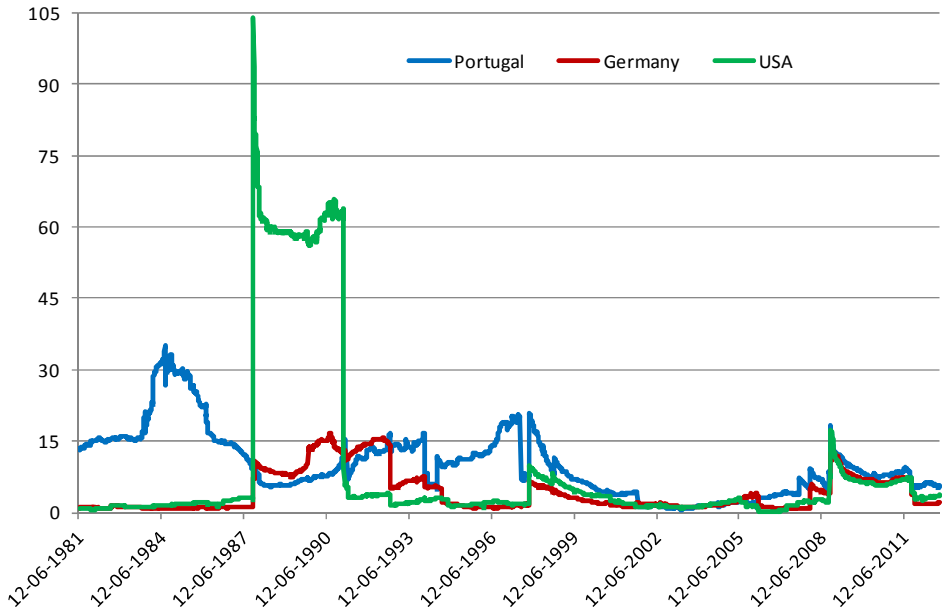


Figure 29b – Evolution of the Kurtosis of the Distribution of the Daily Returns of the Preceding 750 Sessions



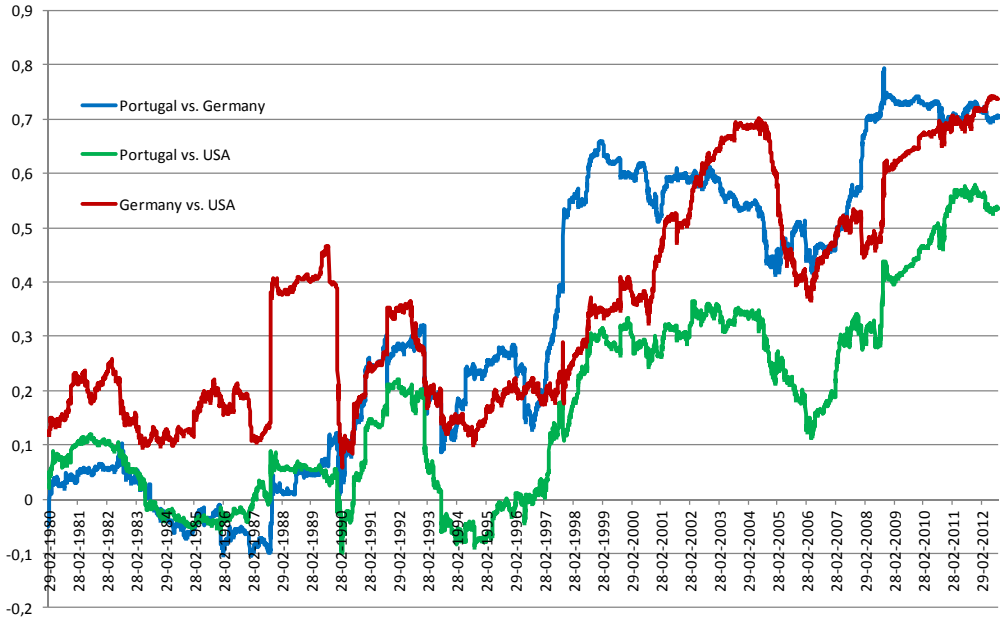
The extremely high values recorded by the US market in 1987 (and in the following years) are worth mentioning. As seen before, the US is a less volatile market, hence extreme market variations recorded in a short period of time produce much more pronounced impacts in the skewness and in the kurtosis. In the case of Portugal, that recorded substantial volatility by 1987, the sharp adjustment recorded in late 1987 and in the following years had a less significant impact on the respective statistics.

5.3. Correlation of Returns and Country-Specific Risk

5.3.1. Correlation of Returns

The correlation between the Portuguese stock market performance and the German and US stock markets performances was very low between 1977 and 1988/1989, remaining below 10% (with the exception of 1981, when the correlation with the US market was 11%) and even recording slightly negative values in 1984-1987. The low correlation between markets was not a unique feature of the Portuguese market, as the correlation between the German and the US markets was also very poor by October 1987, evolving between 10% and 25%.

Figure 30 – Correlation of the Daily Returns over the preceding 500 daily sessions of the Portuguese, German and US Stock Markets between 1977 and 2012



Sources: Euronext Lisbon, Bloomberg

The market crash of October 1987 led to more aligned performances between markets and brought the correlation between the US and the German markets up to levels near 40%. This effect did not reach the Portuguese market in the same degree, as Portugal kept correlations below 10% with the other two markets by 1990.

Between 1991 and 1992 correlation improved to levels between 20% and 30%, but it was not until October 1997 that the correlation between the Portuguese and the German market reached 50%. Since then, correlation has been in the 40% - 80% range, but in a clear upwards trend, remaining close or above 70% since the second quarter of 2008.

The increasing correlation between Portugal and Germany was accompanied by an increasing correlation between Germany and the USA, suggesting a mounting global integration between markets and more aligned performances.

The following table presents the correlation of daily returns for five markets, including Portugal, in the 1989 – 2012 period. The figures confirm a correlation between the Portuguese stock market and each of the three European markets between 50% and 60% and a much lower correlation between Portugal and the US market. It is worth mentioning that the degree of correlation between Portugal and these European markets is lower than the correlations estimated between those markets, which stand between 73% and 81%

Figure 31 –Daily Returns Correlations in the 1989 – 2012 Period
Portuguese, German, French, British and North American Stock Markets

	Portugal	Germany	France	UK	USA
Portugal	1,000	0,559	0,595	0,551	0,335
Germany	0,559	1,000	0,814	0,728	0,515
France	0,814	0,814	1,000	0,814	0,501
UK	0,551	0,728	0,814	1,000	0,490
USA	0,335	0,515	0,501	0,490	1,000

Source: Euronext Lisbon, Bloomberg

Breaking the 1989-2012 period down into two sub-periods, 1989-2000 and 2001-2012, we can see that the correlation between Portugal and these markets increased from the first to the second sub-period, when it surpassed the 60% and the 70% levels with Germany and with France, respectively. Portugal's correlation with the US market also improved, but still remained below 50% in the second sub-period.

In spite of this evolution, the level of correlation between Portugal and the other European markets in the second sub-period still remained below the estimated correlation between the other European markets. All the estimated correlations were strengthened in the 2000-2012 period, with the European markets reaching levels above 80% and 90% between themselves.

These figures confirm that throughout the 1977-2012 period markets became more correlated; European markets became highly correlated between themselves and more correlated with the US market; and Portugal followed this trend of higher correlation but still remained below the levels of correlation achieved by other European markets.

Figure 32a – Daily Returns Correlations in the 1989 – 2000 Period
Portuguese, German, French, British and North American Stock Markets

	Portugal	Germany	France	UK	USA
Portugal	1,000	0,438	0,408	0,341	0,189
Germany	0,438	1,000	0,679	0,567	0,306
France	0,408	0,679	1,000	0,656	0,359
UK	0,341	0,567	0,656	1,000	0,376
USA	0,189	0,306	0,359	0,376	1,000

Figure 32b – Daily Returns Correlations in the 2001 – 2012 Period
Portuguese, German, French, British and North American Stock Markets

	Portugal	Germany	France	UK	USA
Portugal	1,000	0,639	0,717	0,682	0,423
Germany	0,639	1,000	0,894	0,819	0,628
France	0,717	0,894	1,000	0,902	0,577
UK	0,682	0,819	0,902	1,000	0,547
USA	0,423	0,628	0,577	0,547	1,000

Source: Euronext Lisbon, Bloomberg

For example, in the 1989-2000 sub-period, the degree of correlation between Portugal and Germany was 0.438 and the degree of correlation between France and Germany reached 0.679, which corresponds to a 0.241 "gap". In the following sub-period, 2001-2012, the degree of correlation between Portugal and Germany improved significantly to 0.639, but so did the degree of correlation between France and Germany, which rose to an impressive 0.894 level, with the "gap" actually widening to 0.255.

In a different perspective, the correlation between Portugal and (each of) the German, French and UK markets evolved from the 0.341-0.438 range in the 1989-2000 period to the 0.639-0.717 range in the 2001-2012 period, while the correlation between those three markets evolved from the 0.567-0.679 range in the 1989-2000 period to the 0.819-0.902 range in the 2001-2012 period

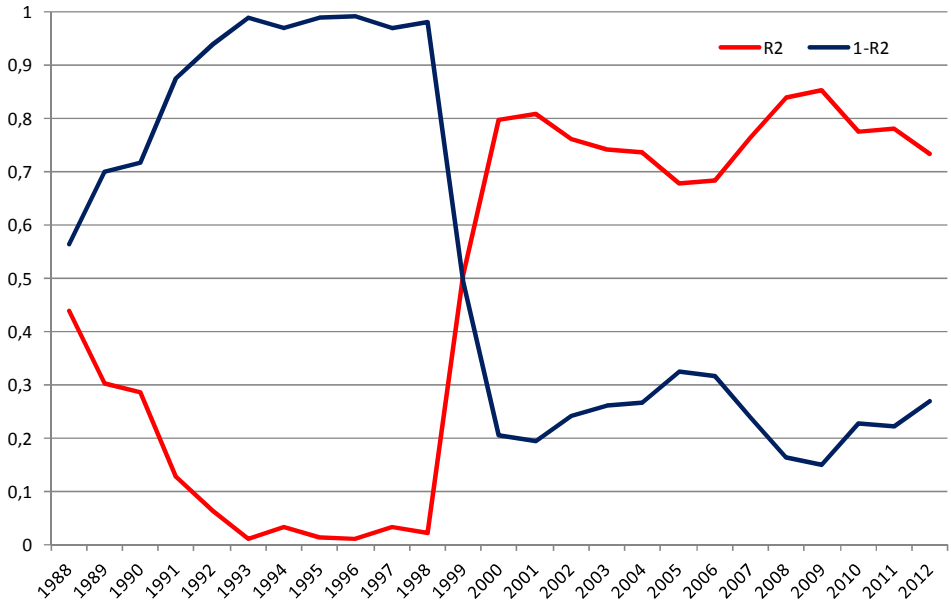
5.3.2. Country-Specific Risk

Figure 33 below presents the evolution of the estimated systemic risk and country-specific risk for the Portuguese stock market between 1977 and 2012. The results were obtained through a multiple regression of the annual returns of the Portuguese and of the German and North American markets, in which the Portuguese market return is explained by the return of the other two markets.

The USA and the German markets are very representative stock markets that reflect the evolution of the US and European economies and to a very large extent of the world economic environment. The volatility of the Portuguese stock market that is explained by the evolution of these two markets may therefore be considered as systemic risk. Conversely, the volatility that is not explained by the performance of these two markets may be viewed as the impact of country-specific factors.

Regressions were calculated using 12 year periods, therefore the lines in the chart correspond to the evolution of "R^2" (systemic risk) and "1-R^2" (country-specific risk) over the preceding 12 years (moving windows).

Figure 33 – Evolution of the Estimated Systemic Risk and Country-Specific Risk for the Portuguese Market in the 1977-2012 Period, using Annual Returns for the Preceding 12 years



Source: Euronext Lisbon, Bloomberg

The weighting of the systemic risk in the Portuguese market's behaviour fell steadily between 1988 ($R^2$of 43.7%) and 1993, when R^2 reached only 1%, and remained at this low level by 1998. The extreme annual changes recorded by the Portuguese stock market in several years between 1977 and 1988 and Portugal's distinctive performance in several years of the 1990s decade clearly conditioned this statistic by 1999.

In 1999 (when the 1977-1987 period is no longer included) the weighting of the systemic risk factor increases sharply, reaching the 50.5% level. Reflecting the more mature market (mainly

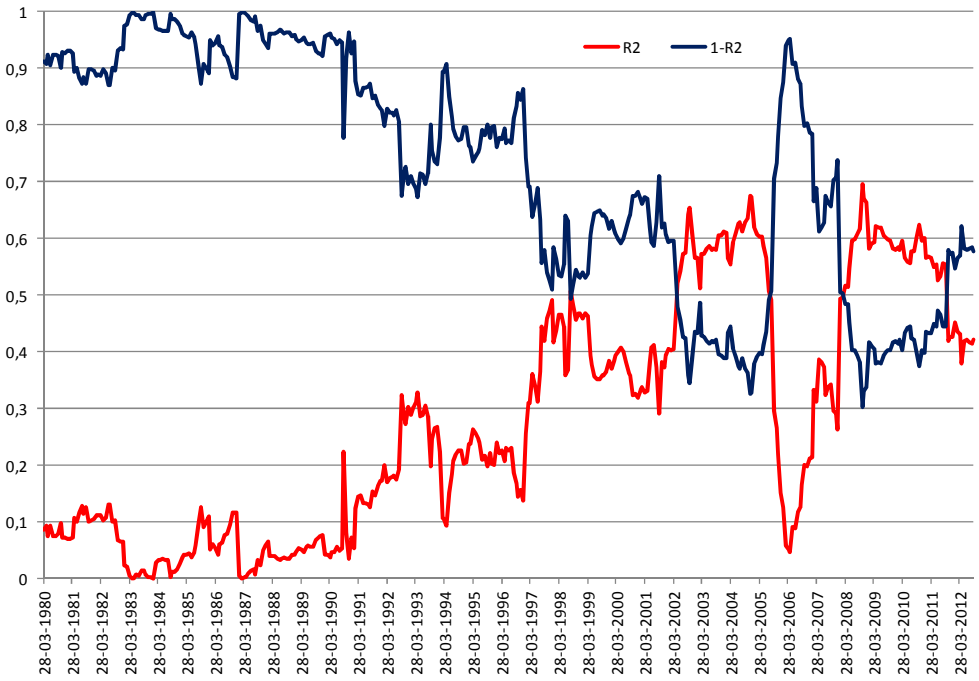
as a result of the privatisation process) and the enhanced European integration fuelled by the adoption of the single currency, the weighting of country-specific risk factors came down to 20% in 2000 and 2001. The trend was reversed in 2002-2006, perhaps reflecting the country's poorer economic performance, but was resumed in the following years, when Portugal accompanied not only the global bull market in 2006/2007, but also the sharp downwards adjustment in 2008 and the global recovery in 2009. In 2009, the country-specific risk reached its lowest level at 14.8%.

In 2010-2012 country-specific risk factors regained some momentum – reaching 26.8% in 2012 -, certainly reflecting Portugal's sovereign debt crisis.

Detailed results of the multiple regressions for the 1977-1988, 1989-2000 and 2001-2012 sub-periods and for the whole 1977-2012 period are shown in figures 6A to 9A in the Annex. They are not very conclusive, although they confirm the increase in correlation from 1977-1988 to the following period of 1989-2000. Unlike the estimates on the correlation of daily returns, results show a decrease in correlation in the 2001-2012 period.

A similar exercise (to estimate the weighting of systemic risk and country-specific risk factors) was performed using monthly returns (36 preceding months) instead of annual returns and its results are illustrated in Figure 34. It is also possible to see the substantial weighting of the country-specific risk factor between 1980 and 1997, when it remained above the 80% level during most of the time, with the exception of the September 1992 – November 1993 period (70% region). The importance of the country-specific risk factor falls in the following years, breaching the 60% level in August 1997 and the 50% level one year later, in August 1998 (therefore comprising the September 1995-August 1998 period).

Figure 34 – Evolution of the Estimated Systemic Risk and Country-Specific Risk for the Portuguese Stock Market using Monthly Returns for the Preceding 36 months



Source: Euronext Lisbon, Bloomberg

The systemic risk factor therefore reached the weighting of the country-specific risk factor at the end of the privatisation programme, but lost steam in the following years, going back to the 40% region by 2002, when it started rising again towards the 60% level, which was achieved in 2004.

Between 2005 and 2007 country-specific risk factors clearly prevailed, reaching the 95% level in April 2006 (comprising the May 2003-April 2006 period). The situation was reversed in the fourth quarter of 2008, with the weighting of the systemic risk factor reaching almost 70% (October 2008) and remaining above 50% by September 2011, when it was surpassed again by the country-specific risk factor.

6 - Conclusions

6.1. Main Results

The three testable hypotheses have been confirmed.

It has been confirmed that between 1977 and 2012 the Portuguese equity market performance has translated into extra returns on treasury bills and on Government bonds consistent with the hierarchy of risks. Portuguese stocks recorded a 24.56% (arithmetic) average return, which compares with 11.70% for government bonds and 9.77% for treasury bills. In real terms, returns reached 14.0%, 2.37% and 0.52%, for stocks, government bonds and treasury bills, respectively.

In nominal terms, Portugal outperformed the reference German and US markets in the 1977-2012 period: accumulated appreciation of 137.9x for Portugal vs. 14.2x and 29.8x for Germany and for the USA, respectively. Discounting by the inflation factor, Portugal recorded a 5.92x accumulated appreciation, below the USA (7.49x) and below Germany (6.07x).

The estimated risk premium for the Portuguese stock market in the 1977-2012 period is estimated at 14.79%, which is higher than the 5%-10% risk premiums typically estimated by other authors for European and North-American markets considering longer periods of time.

It has also been confirmed that the volatility of the Portuguese stock market has been falling and converging towards the levels recorded by other developed markets throughout the 1977-2012 period**.** The standard deviation of the annual returns of the Portuguese market in the 1977-2012 period is estimated at 55.98%, comparing with 25.11% for Germany and 16.60% for the US Market. Considering two sub-periods of time, 1977-1988 and 1989-2012, the standard deviation reaches 81.54% in the former (for a 57.16% average return) and 27.51% in the latter (average return of 8.26%). Volatility was clearly higher during the first 12 years of the period under analysis, when annual market returns above 100% were recorded in five different years.

The volatility of the Portuguese stock market has come down and evolved towards the levels of reference markets such as Germany and the USA, which presented standard deviations of 25.11% and 16.60%, respectively, and average returns of 10.68% and 11.13%, respectively, in the 1977-2012 period. The risk / return relationship has nevertheless evolved unfavourably for Portugal. The Sharpe ratio for Portugal amounts to 0.26 when the whole 1977-2012 period is taken into consideration, but looking at the aforementioned two sub-periods, the ratio comes down from 0.50 to 0.05, well below the 0.22-0.38 range seen for other European and North American markets.

The estimation of the auto-correlation of returns is also unfavourable for Portugal when the whole 36 year period is considered. 0.347 is the auto-correlation of annual returns for the Portuguese market, well above the -0.101 level estimated for Germany and the -0.01 level estimated for the US market. However, a dynamic analysis through moving windows of daily returns auto-correlatio shows the statistic for Portugal falling steadily from 1989 (when the 70% level was achieved) onwards, reaching the 10% level in 2001 and staying below that mark since then and very much in line with the reference German and US markets.

Variance ratio tests indicate a higher statistic for Portugal (30) vis-à-vis the German (18.06) and the US markets (14.29), but the evolution throughout time suggests some convergence. The skewness and kurtosis analysis on the distribution of the Portuguese market daily returns and the tests of normality performed did not confirm the normality of the distribution. However, the evolution of these statistics throughout time suggested some convergence and progressively aligned performance with the German and the US markets from 1998/1999 onwards.

The third hypothesis has also been confirmed: the weighting of country-specific risk factors has been trimmed throughout the 36 year period under analysis and Portugal's equity market performance has become increasingly correlated with the evolution of international stock markets. The correlation of daily returns between Portugal and the German and US markets remained below 10% between 1977 and 1990, improved to the 20%-30% range in the following two years, reached 50% in 1997 and has remained in the 40%-80% range since then, though in a clear upward trend.

The performance of the Portuguese stock market has become more correlated with other markets, but other markets have also become more correlated amongst themselves. The level of correlation between the German and the Portuguese markets increased from 0.438 to 0.639 from 1989-2000 to 2001-2012 (change of 0.201 points), but the correlation between the French and the German markets improved from 0.679 to 0.894 (change of 0.215 points.).

The outcome of the estimation of the weight of the country-specific risk and systemic risk factors on the market performance is consistent with the results mentioned in the previous paragraph. The systemic risk component is apparently almost negligible by 1998 (when the statistics – 12 year moving average - are still being affected by the extreme returns recorded in 1985-1987), but reaches the 50.5% level in 1999, remaining in the 68%-85% range since 2000.

6.2. Other Considerations

Between 1977 and 2012 the Portuguese stock market underwent a substantial expansion in terms of size and trading volumes. The Portuguese market outperformed major markets such as the German and the US markets during most part of this 36 year period, but the relative downwards adjustment Portugal recorded in recent years led to an overall underperformance.

Between 1977 and 1988 the market was conditioned by its small size and low liquidity. When the trading of shares was resumed in 1977, only two years had passed since the nationalisation of companies that represented 90% of the market capitalisation before the April 25th revolution. During this period of time, the trauma was still very present and the economic, political and social conditions did not favour investment: Portugal experienced high inflation, underwent negative economic growth in several years and had short living governments. The country was also dealing with the integration of almost 1m people arriving from the former African territories and with the reversion of some measures taken during the hottest days of the revolution.

In December 1985, four companies (Marconi, Efacec, Inapa and Celulose do Caima) represented more than 60% of the market's capitalisation. The small number of listed companies and poor liquidity jeopardised the market's dynamism in the very early years, but

fuelled the market's euphoria in the late years of this period. The Portuguese stock market went up more than 100% in each of the three years of the 1985-1987 period. Apart from the favourable international conditions (1985 was the best year for the German DAX and one of the best years of the S&P index between 1977 and 2012), the performance of the Portuguese market also reflected the country's improving "fundamentals", namely the pro-European stance followed by all the Governments since 1976 and that culminated with the accession of Portugal into the European Union in 1986 (in 1977 the Portuguese government requested the beginning of the negotiation process for the accession of Portugal into the European Community - negotiations officially started in October 1978, but it was not until 1980 that they were launched in effective terms (Costa, 2011), having lasted until 1984, with the accession treaty being signed in June 1985); economic growth of more than 3% and above the European average; falling inflation; and increasing political stability (for the first time, in 1987 a single political party got a majority number of seats in the Parliament).

The granting of (fiscal) incentives to issuers and to investors in 1986/1987 translated into a substantial increase in the number of listed companies and into a mounting visibility of the stock market. However, most of these newly listed companies (more than 80 companies from different sectors of activity) were small or medium sized companies and did not contribute much to a deeper or more liquid market. This situation actually contributed to the escalation of the market euphoria, which, combined with the lack of preparation of many participants, produced the outstanding appreciations of the 1985-1987 period.

The stock market's evolution in 1987 clearly demonstrated the inefficiencies of a thin market. The market ended the year with an almost 200% gain, but in early October 1987 it was recording a 700% gain year to date (having therefore undergone a sharp correction by the year end). In that year, many IPO and share capital increases took place, with companies aiming to benefit from the market's good momentum to issue shares, on top of the previously mentioned fiscal incentives. There was a generalised enthusiasm that led to irrational situations, such as the non-adjustment (downwards) of share prices when a bonus issue ("aumento de capital por incorporação de reservas") took place. Celulose do Caima's share capital increase (carried out in 1987) was a landmark in this aspect.

The market boom ended in 1987 not without leaving a (another) trauma in many investors. Only the privatisation programme, started in 1989, launched the market into a new (expansion) path. The privatisation process brought to the market the country's largest companies, allowing a better representation of the different economic sectors (namely power, gas, financial services) and translating into a much higher market capitalisation, closer to the levels seen in major markets. The process also attracted international investors and substantially contributed to enhance liquidity.

It was therefore from the 1990s onwards that the Portuguese stock market reached size and liquidity indicators more consistent with reference international markets. Apart from the national policy of privatisations, the consolidation of the supervision and regulation of the stock exchange, the progressive disintermediation, the perspective of Portugal joining the single currency and increasing financial innovation also contributed to the market's impressive development (Curto, 2004). Nevertheless, at the end of the decade, the trading volume (in relative terms) was considered still low in comparison with the German market (which in turn

was still far from the US market). During this sub-period of time, the Portuguese market also experienced lower volatility and saw its correlation with other markets rising, which was further reinforced in the following decade.

A comparative analysis with other countries suggests nevertheless that in the case of Portugal country-specific factors still have a relevant influence on the market's performance, leaving Portugal with correlation coefficients with major markets below the correlation coefficients those markets have between themselves. The fall (though small) of correlation coefficients with the German and the US markets in 2011/2012 (when the correlation between these two major markets increased) seems to confirm this point – Portugal's debt sovereign problem translated into some decoupling with other markets and penalised the country's relative performance.

6.3. Final Notes

The point addressed in the previous paragraph raises a limitation this study faces. Researchers (Dimson, 2001) usually take longer series – in some cases with more than 100 years – to estimate market risk premiums and to perform return vs. risk analysis. The 36 year period considered in this analysis could therefore be considered as too short to enable the achievement of relevant conclusions, a limitation that might be further enhanced by the market's small size and poor liquidity by the late 1980s. However, many authors (Brealey, 2011) also question the idea of risk premium remaining unchanged over very long periods of time, even in very developed markets such as the USA or the United Kingdom or Germany, which have undergone steady economic growth and have been living with stable political, legal and social environments for almost 70 years.

As mentioned in the Introduction, the main objective of this paper is to get a more objective and supported sense of the main parameters of the Portuguese stock market and the analysis of information available for this 36 year period certainly contributes to that end. Moreover, in the case of the Portuguese stock market, it is certainly less difficult to accept the idea that the premium on the risk free interest rate demanded by an investor in 2012 is different from the premium an investor sought in 1977 or in 1990.

There are several related issues that although interesting and appealing were not addressed or developed in this document. The focus of the document did not allow a deeper analysis of subjects such as "market liquidity vs. market performance", "market efficiency", "weight and influence of international investors in the stock market", "the stock exchange as a leading indicator of economic growth", or "country driven performance vs. sector driven performance". Another very interesting issue would have been the characterisation of the Portuguese market in terms of value stocks vs. growth stocks and big companies vs. small companies and their performance throughout time. These are themes that I would like to address in the future.

In the 1977-2012 period, the Portuguese market underperformed in overall terms the German and the US markets and the return it achieved did not seem to compensate for the implicit risk premium. However, had this analysis ended in 2010 and the results would have been different, with Portugal outperforming the major stock markets and presenting more decent rates of

return. This seems to confirm the idea that in spite of all the developments achieved over the last two decades, given its small size and “peripheral” status, Portugal is still more vulnerable to country specific factors. Hopefully this will translate into a new period of outperformance in the near future.

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Annex

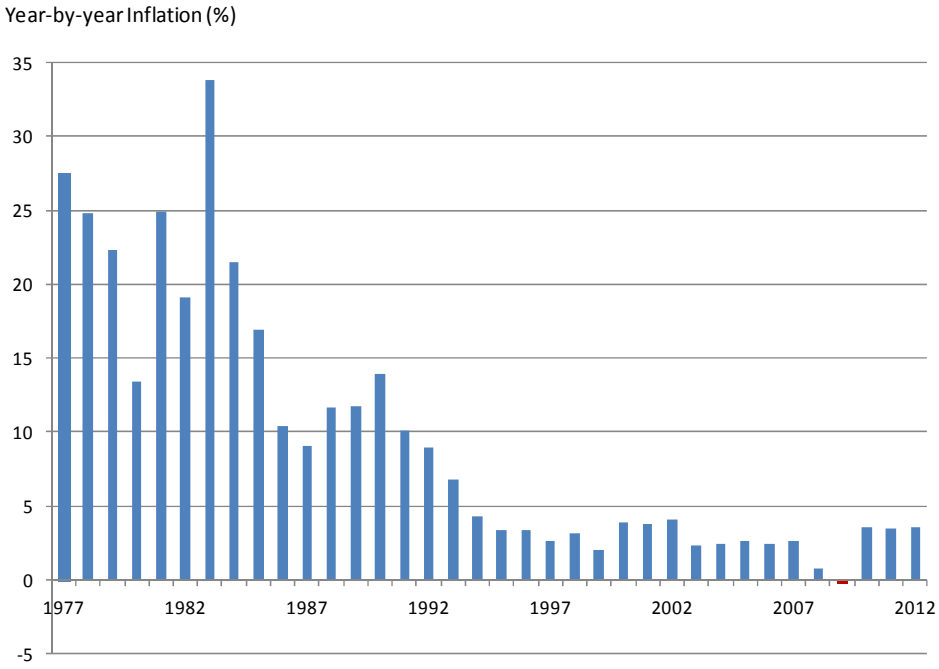
Figure 1A – Companies Listed in the Portuguese Stock Market as at 31 December 1973

Sector	Company	Market Cap PTE '000	Sector's weighting
Textile	Fábrica de Fiação de Torres Novas	51 600	0,02%
Banking	Banco Agricultura	5 519 500	
	Banco Alentejo - Portador	6 384 000	
	Banco Algarve	2 350 000	
	Banco Angola - Portador	3 102 500	
	Banco Borges & Irmão	8 610 000	
	Crédito Predial	7 810 000	
	BESCL	18 000 000	
	Banco Fomento Nacional	12 000 000	49,42%
	Banco Fernandes Magalhães	3 150 000	
	Banco Fonsecas & Burnay - Portador	10 446 800	
	Banco Intercontinental	13 600 000	
	Banco Nacional Ultramarino - Cupão	12 000 000	
	Banco Pinto & Sotto Mayor	24 600 000	
	Banco Português do Atlântico - Portador	14 041 500	
	Banco Totta & Açores - Portador	11 700 000	
	Banco Pinto Magalhães	5 460 000	
Insurance	Seguros Alentejo	948 000	
	Seguros Aliança Madeirense	900 000	
	Seguros Atlas	1 450 000	
	Seguros Bonança	1 688 000	
	Seguros Douro	400 000	
	Seguros Europêa		
	Seguros Império	5 000 000	
	Seguros Lusitana	360 000	
	Seguros Mundial	2 600 000	7,52%
	Seguros Mutualidade		
	Seguros Nacional	742 500	
	Seguros Nauticus	369 000	
	Seguros Pátria	975 000	
	Portuguesa de Seguros (soc.)	792 000	
	Seguros Sagres	462 500	
	Seguros Soberana	540 000	
	Seguros Tranquilidade	6 946 000	
Water	Águas da Curia	382 500	
	Águas de Lisboa - Portador 1934	200 000	0,47%
	Vidago, Melgaço e Pedras Salgadas	923 000	
Power	Companhia Portuguesa de Electricidade	7 695 000	
	Eléctrica das Beiras	270 000	
	Gás e Electricidade - Cupão	1 982 520	
	Hidro Eléctrica Alto Alentejo - Cupão	992 200	4,40%
	Hidro Elétrica Norte Portugal (Chenop)	1 699 500	
	Hidro Eléctrica Serra da Estrela	340 000	
	União Elétrica Portuguesa	1 150 000	

Cement	Cimentos de Leiria - Portador	20 250 000	
	Cimento Tejo - Portador	19 200 000	12,28%
Pulp and Paper	Celulose do Guadiana	360 000	
	Portuguesa de Celulose	2 565 000	0,91%
Others	F. Ramada	520 000	
	Fornos Eléctricos	1 350 000	
	Siderurgia Nacional - Portador	15 251 778	
	SOCEL	1 875 000	
	CIDLA	1 855 000	
	União Fabril	9 660 000	
	Intar	408 889	
	Nitratos de Portugal	340 000	
	Petroquímica	832 500	
	Sacor	10 500 000	20,12%
	Tabacos de Portugal - Cupão	900 000	
	Tabaqueira	3 200 000	
	União Fabril do Azoto	675 000	
	Grão-Pará	2 376 000	
	Industrial Portugal e Colónias	2 160 000	
	Lisnave	7 750 000	
	MATUR	840 000	
	Navegação Nacional - Portador	2 012 500	
	Navegação (Colónia)	1 260 000	
	Portuguesa de Pesca	187 500	
	SALVOR	675 000	
Tourism	TAP	1 600 000	
	Turística da Penina	500 000	2,14%
	Rádio Marconi - Portador	4 784 000	
Overseas	Agrícola de Cassequel	442 750	
	Agrícola de Incomati	157 500	
	Açúcar de Angola	382 500	
	Algodões de Angola (Cotonang)	144 000	
	Angolana de Agricultura		
	Buzi	300 000	
	Cabinda	92 400	2,72%
	Fina (Combustíveis do Lobito)	920 000	
	Diamantes de Angola (T. 50)	4 757 500	
	Hidro Eléctrica do Revué	137 500	
	Moçambique	704 000	
	Sonefe - Portador	624 000	
	Zambézia	75 000	
TOTAL		**321 258 937**	**100,00%**

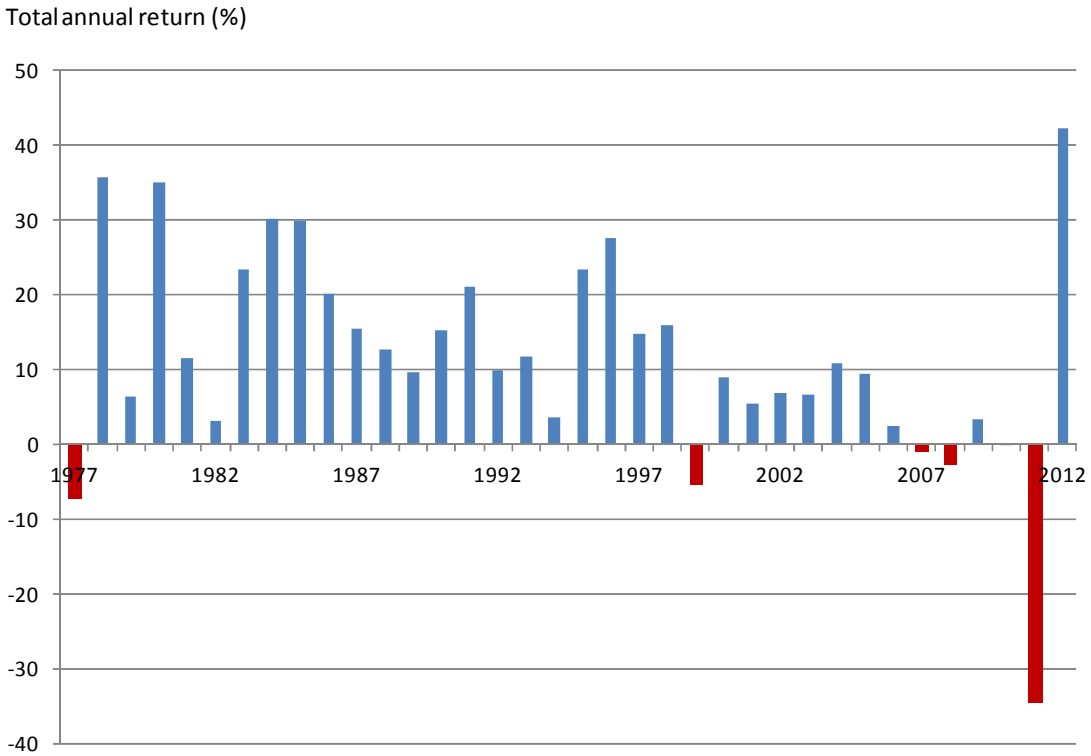
Source: Euronext Lisbon

Figure 2A – Year-by-Year Portuguese Inflation



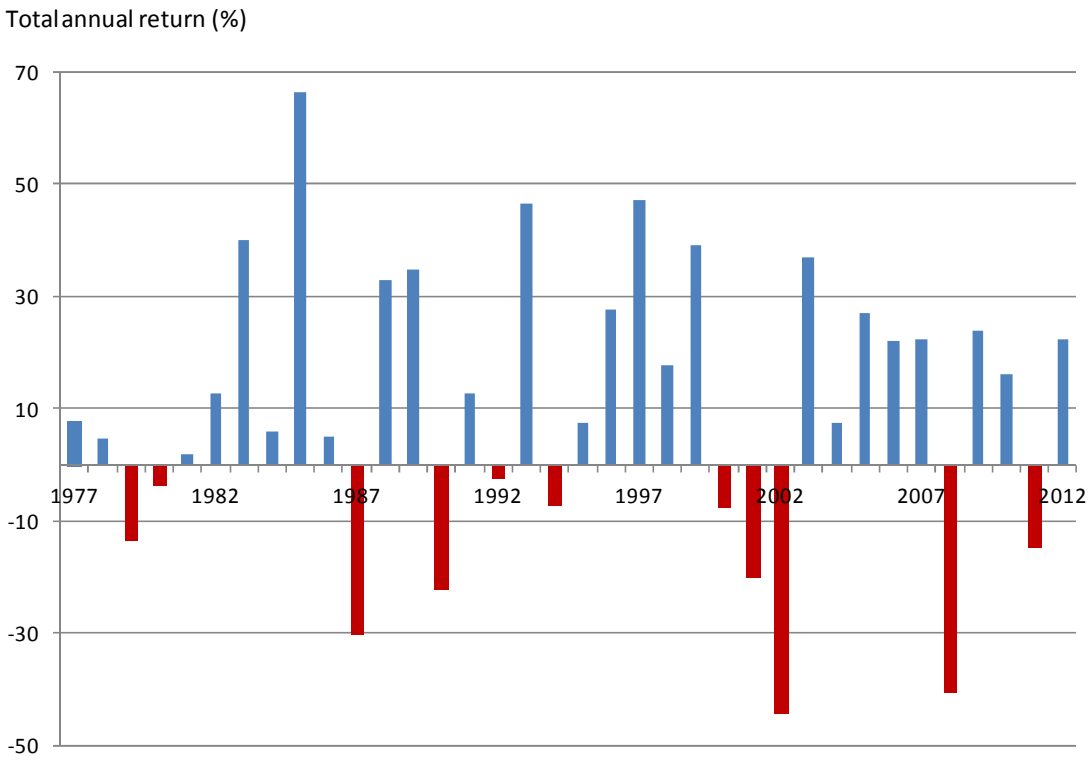
Source: Banco de Portugal

Figure 3A – Year-by-Year Total Returns on (long term) Portuguese Government Bonds



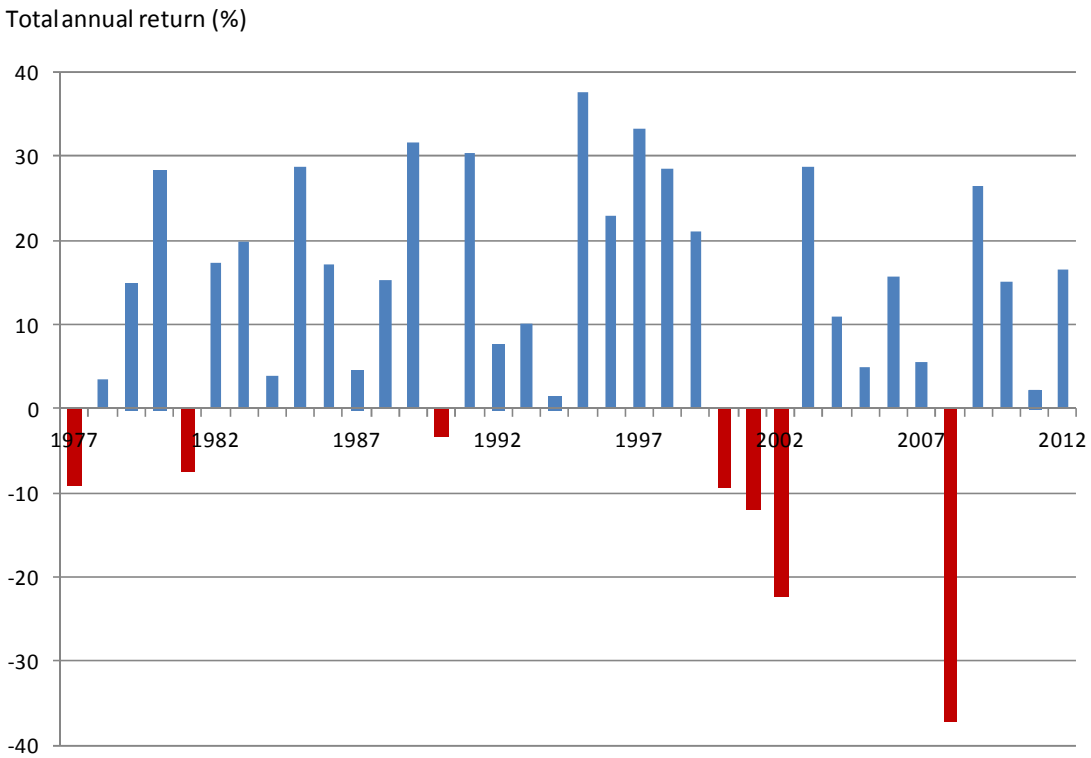
Source: Euronext Lisbon, Bloomberg

Figure 4A – Year-by-Year Total Returns on German Stocks (DAX)



Source: Bloomberg

Figure 5A – Year-by-Year Total Returns on US Stocks (S&P TR)



Source: Bloomberg

Figure 6A – Multiple Regression of Annual Returns in the 1977-2012 period
Portuguese Market Return explained by the Return of the German (Variable 1) and of the USA (Variable 2) Markets

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0,436069
R Square	0,190156
Adjusted R Square	0,141075
Standard Error	0,518794
Observations	36

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	2,085517	1,042759	3,874305	0,030805
Residual	33	8,881859	0,269147		
Total	35	10,967376			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	0,082005	0,105038	0,780716	0,440534	-0,131696	0,295706	-0,131696	0,295706
X Variable 1	-0,367509	0,491077	-0,748375	0,459535	-1,366612	0,631594	-1,366612	0,631594
X Variable 2	1,807094	0,742818	2,432754	0,020570	0,295819	3,318368	0,295819	3,318368

Figure 7A – Multiple Regression of Annual Returns in the 1977-1988 period
Portuguese Market Return explained by the Return of the German (Variable 1) and of the USA (Variable 2) Markets

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0,661640
R Square	0,437768
Adjusted R Square	0,312828
Standard Error	0,675873
Observations	12

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	3,201111	1,600556	3,503815	0,074924
Residual	9	4,111233	0,456804		
Total	11	7,312345			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	0,198688	0,271039	0,733059	0,482178	-0,414446	0,811821	-0,414446	0,811821
X Variable 1	-1,539344	0,897509	-1,715130	0,120461	-3,569650	0,490962	-3,569650	0,490962
X Variable 2	4,737032	1,843022	2,570253	0,030175	0,567827	8,906238	0,567827	8,906238

Figure 8A – Multiple Regression of Annual Returns in the 1989-2000 period
Portuguese Market Return explained by the Return of the German (Variable 1) and of the USA (Variable 2) Markets

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0,892271
R Square	0,796147
Adjusted R Square	0,750847
Standard Error	0,142322
Observations	12

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	0,711977	0,355988	17,574784	0,000780
Residual	9	0,182301	0,020256		
Total	11	0,894277			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	-0,012839	0,063329	-0,202727	0,843858	-0,156099	0,130422	-0,156099	0,130422
X Variable 1	1,181230	0,234086	5,046135	0,000694	0,651691	1,710770	0,651691	1,710770
X Variable 2	-0,207240	0,343052	-0,604105	0,560691	-0,983278	0,568799	-0,983278	0,568799

Figure 9A – Multiple Regression of Annual Returns in the 2001-2012 period
Portuguese Market Return explained by the Return of the German (Variable 1) and of the USA (Variable 2) Markets

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0,855507
R Square	0,731892
Adjusted R Square	0,672312
Standard Error	0,150590
Observations	12

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	0,557147	0,278574	12,284253	0,002675
Residual	9	0,204096	0,022677		
Total	11	0,761243			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	-0,024268	0,044907	-0,540397	0,602038	-0,125855	0,077319	-0,125855	0,077319
X Variable 1	0,438200	0,398057	1,100848	0,299533	-0,462267	1,338668	-0,462267	1,338668
X Variable 2	0,561170	0,561406	0,999580	0,343629	-0,708819	1,831159	-0,708819	1,831159

Figure 10A – PSI-20 Index Members as at September 30th, 2012

Company	Index Weight
Portugal Telecom	17,55%
EDP - Energias de Portugal	17,28%
Galp Energia	16,96%
Jerónimo Martins	16,57%
EDP Renováveis	5,68%
Banco Espírito Santo	3,40%
Sonae	3,10%
Zon Multimedia	3,03%
Banco Comercial Português	2,93%
Espírito Santo Financial Group	2,39%
Portucel	2,39%
Banco BPI	1,97%
Semapa	1,77%
REN - Redes Energéticas Nacionais	1,57%
Altri	1,25%
Sonaecom	0,94%
Mota-Engil	0,56%
Sonae Indústria	0,29%
BANIF	0,21%
Cofina	0,16%